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Training Leaders For Foremanship Classes

Fundamental Factors Involved in Training Leaders — Outstanding Characteristics of the Typical Foreman — Importance of Follow-Up Work in Organizing Courses

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AMONG the many perplexing questions which have arisen in connection with foreman training is that of finding men who are competent to conduct classes in this field. There are those—and they are not few in number— who maintain that whether or not the foreman training movement is to succeed or fail on the whole, will depend primarily upon the quality of leadership established and maintained and upon the finding of some effective means of preparing the right kind of leadership.

It was shortly after the work in foreman training was launched on a relatively large scale by certain agencies, that the writer foresaw the absolute necessity of finding and training candidates for carrying on such work. At that time (June, 1919) I believed and stated that it is possible to train a man from each industrial plant so that he can organize and conduct foremanship classes within the plant represented. An experience of two years has caused me to modify this point of view. I now take the position that it is possible and desirable to train one man or more in each plant to an intelligent appreciation of the scope and meaning of foreman training work, even to get him to the point where he knows how to proceed to build up a training course which is suitable for the foreman in his plant. But I no longer believe that the average executive may be satisfactorily prepared by means of short unit training courses for organizing and conducting classes for foremen. It is one thing to select and organize suitable material and quite another thing to make proper use of this material while standing in front of a group of foremen. Many can do the former, but few the latter.

The Fundamental Factors Involved

The following article sets forth briefly the fundamental factors involved in training leaders of this type; also the most important conclusions reached after an experience of two years. One point should be clear, however, before proceeding further, namely, that the task of training leaders for foremanship classes, as considered and referred to herein, is in no sense incidental or subordinate to something else, a position obviously given to it by some, shall I say, superficial students in the field. It is a real, honest-to-God job which must neither be left undone, nor done improperly, if the whole movement is to progress as it should.

When the work of training leaders for this work was faced, some fundamental questions had to be answered, among them being: (1) What should go into a foreman training course? (2) How should the material in a training course be organized? (3) How should foreman classes be conducted? (4) What constitutes good foremanship?

In answering these, the reverse order was followed. In other words, the first thing attempted was to get clearly in mind who the good foreman is, what his chief characteristics are, etc. Following this came a study of the needs of foremen as revealed by and through their shortcomings, this, in turn, giving way successively to a consideration of how to get hold of proper material for a course, how to get this material into shape for class or conference purposes, and, finally, how to conduct the class conference. In endeavoring to answer these, others of equal, if not greater importance, arose, such as: (1) What fundamental traits, habits, attitudes, etc., of foremen must be considered by one who is to conduct foreman classes? (2) In what respects does a good foreman differ from a poor foreman? (3) What are the most important characteristics of the type of foreman that training courses are expected to produce?

Outstanding Characteristics of the Typical Foreman

While helpful discoveries resulted from the consideration of each question, doubtless the most important contributions came from a study of how to conduct a class or conference successfully. The major factor to be reckoned with in this connection, as well as in connection with the organization of the material for the class, it was found, had to do with the inherent nature of the typical foreman as a subject for training. To a majority of the candidates, this analysis of the foreman from the standpoint of how he must be dealt with, in order that good results might be realized, was decidedly a new thing.

The analysis referred to revealed the typical foreman as possessing the following outstanding characteristics: (1) He is mature both in mind and body; (2) he is a "self-made" executive, his schooling having been obtained chiefly in the "university of hard knocks"; (3) he usually has plenty of confidence in himself and his ability; (4) new ideas or methods are not ordinarily welcomed by him; (5) one of his most pronounced weaknesses is inability to analyze; (6) he has little use for theory, practice being his strong point; (7) above everything else, he enjoys "talking shop"; (8) his best thinking is done when he is cornered; (9) he is extremely jealous of authority; (10) he will not co-operate heartily with any one in whom he does not have utmost confidence.

The importance of the above principles to one who contemplates carrying on foreman training work of

any kind need not be pointed out. Observance of them is imperative not only to success in conducting classes or conferences, but as well in selecting and organizing subject-matter.

What better clue does one need, for example, regarding the source of subject-matter for a training course than that formen enjoy "talking shop"? Does not this speak volumes for "home-grown" rather than for imported courses? Below appear samples of foreman problems contributed either directly or indirectly by foremen through their executives.

(1) When an employee is absent on account of sickness or accident, and the foreman finds that the substitute employee is superior to the regular one, should he reinstate the regular one when he is again ready for work?

(2) Should foremen ever attempt to discipline employees by transferring them to distasteful jobs?

(3 What should be the order in which a foreman should recommend the following types of workers for wage increase?

(a) One who has not had a raise for six months or more; (b) one who has somehow managed to increase his efficiency since the prevailing rate was fixed; (c) one who is a "good fellow" in the department; (d) one who is steady and reliable; (e) one who is doing as good work but is not drawing as high a wage as the others in the department.

(4) How should a foreman deal with a man who is an excellent workman, but who is always carrying matters over the foreman's head?

(5) An important question of transfer: Would you favor transferring a man who had been thoroughly trained for work in your department and who is giving excellent service, to a position in another department which could not at the time be considered a promotion, but which obviously has greater future possibiii-ties in it?

(6) If a worker asks his foreman for information regarding the work which the foreman is not qualified to furnish at the time, which of the following courses should the foreman take:

(a) Admit his inability to answer the question and assure the worker that he will find out and let him know as soon as possible, or (b) give some sort of answer, in other words, "bluff it out," and run the risk of being found out later?

(7) How is a foreman to meet the practical problem of getting workers to appreciate the importance of their work, e.g., handling hard iron carefully?

(8) What method should a foreman pursue in trying to lead a man to have a higher regard for both his own and for his fellow-workers' welfare?

(9) How should a foreman attempt to manage workers (a) who deliberately "kill" time in order to make the job last longer, and (b) who have the habit of taking it easy whenever the "boss" is not around?

(10) What would be the best way for a foreman to meet a situation like the following: Due to negligence or incompetence on the part of the inspection department, extra operations are made necessary in a certain foreman's department, the cost for which is, of course, charged against him.

(11) A problem of discipline: How can a foreman cut down (a) tardiness and (b) absenteeism in his department?

(12) How is a foreman to plan and carry out a schedule of work consisting of short orders when he has only piece-workers in his department?

(13) How are foremen to keep their men "sweet" during a period when satisfactory piece-work prices are being determined; also during a "try-out" period when piece rates are being modified?

(14) What would be the sensible thing for a foreman to do when a reduction in working hours has reduced the weekly wage of his men, as a consequence of which they are demanding an increase in wages?

(15) A foreman is "up against" the demand for increased production when his machine capacity is limited. What should he do?

(16) This is a foreman's problem. How should he solve it? A new piece-work price has been sent on a certain job; his men before giving it a proper trial, protest that the price is too low for them to make the established rate.

(17) What should a foreman do when one of his men who has produced defective parts refuses point blank to re-operate the parts in order to correct the defect; this re-operation, of course, to be done without pay?

(18) How should a worker be dealt with of whom the following is true:

(a) Too many just complaints are coming in against the work he is doing; (b) he has been cautioned several times regarding the quality of his work; (c) temporary improvement followed each warning; (d) he is otherwise a capable man, one that would be hard to replace.

(19) What would be the best course for a foreman to take when, following the establishing of a new rule regarding methods of handling the work, a delegation of twenty workmen wait on him and protest against the rule?

(20) A question of policy: In case the management is operating "open shop," should a foreman, when lack of orders necessitates reducing the working force, recommend for discharge those workers who are known to be union members or labor agitators, regardless of their workmanship ability?

(21) Another question of policy: If at the time of hiring an employee he is told that his rate will be increased if he "makes good," what should a foreman do when the following conditions prevail: The man works conscientiously and his production steadily improves, but it does not yet equal the average of men on the next higher rate. The foreman is satisfied that the man will make a good employee. The man thinks he has "made good" and requests his increase.

(22) The manufactured product is very delicate in nature. Employees are paid by the hour. How can a foreman put over the idea of waste prevention successfully?

(23) An employee goes home at 10:30 a.m., leaving a note for his foreman claiming that he is sick; but fellow-employees state that no signs of sickness were observed. Should he be reprimanded or discharged?

(24) What should be done with a man who repeatedly ignores safety and sanitation rules?

(25) In case men quit without giving previous notice and want their money before the regular pay day, is a foreman justified in refusing their request? Or should he yield to such demands?

(26) There is no dead wood in the department, but due to lack of work it is necessary to reduce the working force 25 per cent. On the basis of a square deal and with an eye to resuming operations again, which man should be laid off?

(27) Two groups are working on jobs very similar in nature. One job requires several times more actual handling than the other, which is largely an automatic machine product. The first group, due to the greater amount of handling time necessitated, are able to increase their earnings through increased efficiency. The second group, however, cannot do so because the automatic machine speed cannot be increased. What should be done to correct the inconsistency?

(28) Temporary lack of work in the department means reducing the number of men in the department, all of whom are active and valuable workers. Shall the department work part time or shall part of the force be paid off, permitting the remaining ones to work full time?

(29) In a plating department it is necessary to transfer castings from tank to tank. The workers are paid upon a piece basis and have been lifting the equivalent of 35 pounds at a time. This affords a sufficient speed to earn a consistent weekly wage. They now complain that the work is too hard. What should be done?

(30) A separate operation costs one-half cent per piece. A fixture can be provided to include this operation with another without increasing the cost of the former operation. The fixture would cost $900. What factors should be analyzed before the foreman recommends expenditure for the new fixture?

(31) A machine hand is working at a machine flooded with oil. He is a good operator and the class of work he is doing permits very consistent compensation. The contact with oil, however, causes obnoxious skin eruptions, which medical treatment does not correct. What action should the foreman take?

. The field of foreman training, it was found, breaks up nicely into five divisions, namely: (1) The economics of business, or, in other words, the various factors involved in making it a going concern; (2) managing men; (3) scientific methods of production; (4) technical knowledge, that is, science, mathematics, drawings, etc.; (5) getting one's ideas over to the other fellow, or instructional ability.

It will be easily apparent that one need not go further than these same fundamental principles in order to find a clue for organizing his material for class use and for conducting the class or conference. If a good foreman must think straight and if, as is pointed out, he does his best thinking when he is "cornered," is it not obvious that the discussion rather than the lecture method should predominate in class? And if he is "self-made" or largely so, and is unreceptive to entirely new points of view, hasn't one adequate reason for assuming that the method should be one of discussion which is directed but not dominated by the leader? Finally, if foremen, as a class, analyze poorly, what more does the prospective leader need in the way of a warning that he must think the points through before taking charge of a class and must see that the successive steps necessary to a thorough analysis of the topic are taken by the members of the group?

Below are summarized the main points on method revealed through our analysis of the problem. It will be observed, of course, that certain of these apply more particularly to some than to other types of training courses. For example, technical information courses must be conducted more or less by the lecture method, while a course on managing men would lend itself nicely to discussion.

1. Be thorough but not pedantic. Get down to fundamental principles but do not overwork them. Think the unit of work through rather than trust to inspiration.
2. Get something worth while accomplished at each session.
8. Make use of the foreman's daily problem.

rather than by expressed opinion.

4. Be sensibly sympathetic but not afraid to take and defend a position for the sake of argument.
5. Make much use of developmental method. Get the men to think for themselves.
6. Give practical assignments at least occasionally. Make it difficult for the men not to think of their jobs in a new way between sessions.
7. See that the men stick to the point of discussion.
8. Make use of the foreman's daily problem.
9. Suggest current articles appropriate for reading.
10. Study the members of the group constantly.
11. If lectures constitute a part of the course, see that they are well organized and that questions for promoting discussions are provided.
12. Above everything else do not give the impression that you are trying to tell them something they do not know.

There yet remains the final and very important step, namely, that of helping representatives from industrial plants, who have completed the first unit of the work, to compile and organize material for their respective foreman training courses. In fact, it is here that one of the greatest services can be performed. Briefly, this is what takes place: The plant representative gets hold of as many as possible of the foremen's problems, those things which cause them trouble day after day. After these are analyzed and classified, they are organized into units or topics for class use.

I consider this "follow-up" work if anything more important than the so-called main course, since experience has proven that with rare exceptions, however well disposed and ambitious the industrial executive is, he tends to overlook or undervalue certain principles of method which are vital to success. If, as has been authoritatively asserted on different occasions, the supreme weakness of the scientific management movement was its emphasis of the material to the detriment of the more important human side of production—an assertion which is undoubtedly well founded—it stands to reason that any movement which has for its purpose the focusing of merited attention upon the key-man and all, rather than a part of his problems, must not make the mistake of stopping short of its goal.

It is the writer's conviction that educational institutions will miss one of their greatest opportunities to serve society if they do not increasingly endeavor, through such practical methods as herein set forth, to make their accumulated experience and information, particularly in the fields of psychology, sociology, and pedagogy, function in practical industrial situations; and that likewise industry will pay a heavy penalty if it does not welcome this opportunity for co-operative effort in overcoming obstacles which, to say the least, are extremely baffling. Let not the common mistake however be repeated, namely, of trying to get the job done in thirty days. It may not be generally appreciated but it is nevertheless true, that industrial executives, as a class, lack the patience necessary to make a thoroughly scientific study of a problem. There is no one class of men who have greater need for and can make greater use of a knowledge of psychology and its application to their numerous problems.

Machining the Wrigley Automobile Transmission Gear

II. Using Mechanical Conveyors to Eliminate Handling—Progressive Machining of Automobile Parts—Inspection Tools and Methods for Rough and Finished Parts

By I. WILLIAM CHUBB
Editor, European Edition, *American Machinist*

TURNING to the details on machining operations, it may be mentioned that Newall "A" limits are worked to, except as to ball races where Hoffman sizes are used. To pass the job from one machine to

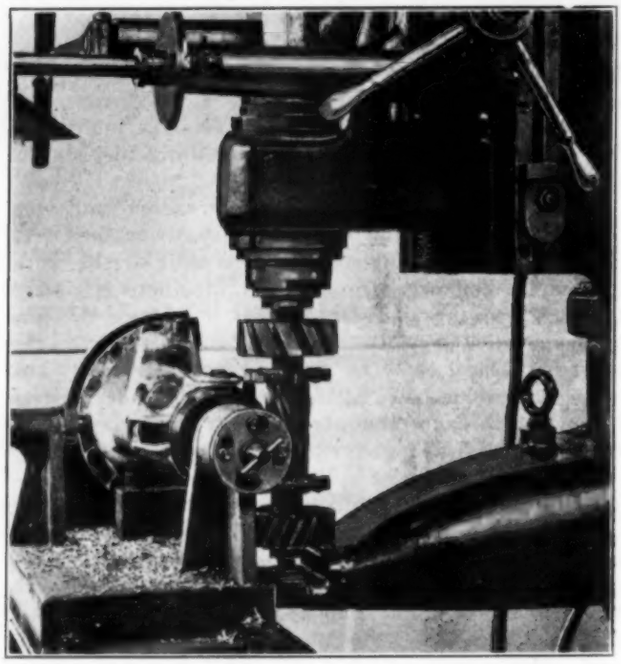

FIG. 8. GEAR BOX MILLING TOP COVER SEATING AND SIDE BOSSES

the next either roller-ways or light band conveyors are used, according to the weight of the article to be moved; only on rare occasions is it carried by a man. In the case of the roller-ways, gravity is employed, the rollers, which are of drawn tube 2½ x 14 in. wide with 4-in. pitch, being set, of course, on an incline and running on ball bearings. The incline can be adjusted by screw to insure correct speed. The endless bands employed are about 12 in. wide, driven by gearing and overhead shafting. In some cases a man standing at his station simply removes the job that tends to pass him; in other cases chutes of sheet metal are formed, into which the job is trapped, the belt passing underneath the chute.

Machining the Gearbox Case

The gearbox case is an aluminum casting, the machining of which calls for operations in six stages, all of about equal times. The first operation, see Fig. 8, is gang-milling in a Herbert No. 8 vertical machine, the surfaces tooled including the top face, the side bosses and the foot-brake bracket seatings. The box is placed in an angle fixture, as shown, bearing on the cone chamfer at the engine end and the fixture picks up through the casting on the large flange at three points with adjustable studs. The plunger opposite the 3-point support of the cone is forced up by a screw. The slot between the webs is important because of the hole subsequently to be bored there. This hole is for the lay-shaft bearing and adjustment is effected by two jacks below, the three studs at the large cone end and one at the side taking the pressure. As regards the gang of cutters, two operate over the top cover face, two over the bosses, and the outer cutters take the two side faces, one facing the seating for the foot-brake bracket, the other to help line up with the engine. In a No. 9 Rockford miller the same operation also mills the primary shaft-housing face. The face previously milled is used to locate the box in the fixture, a

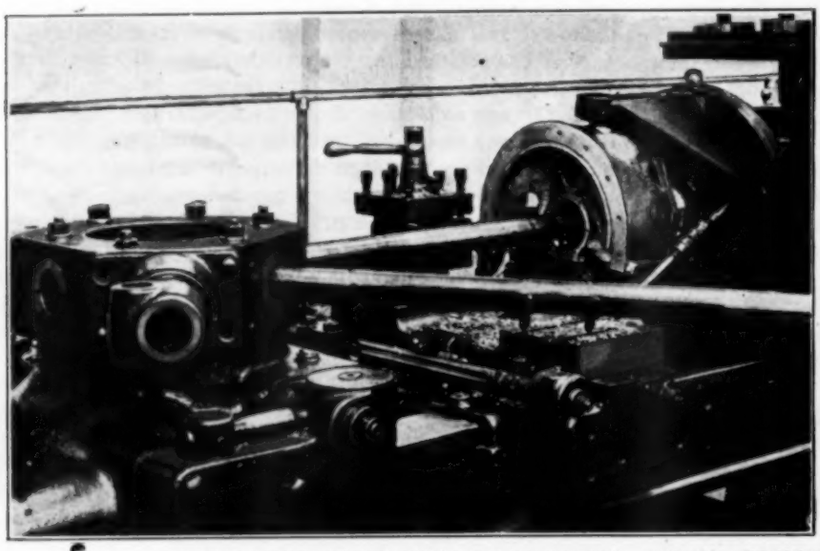

FIG. 9. BORING MAIN SHAFT HOLES IN GEAR BOX.

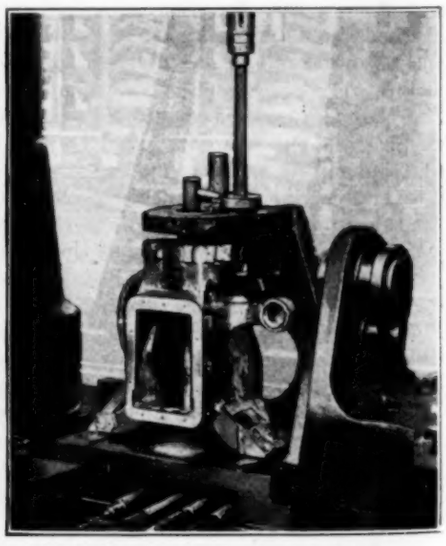

FIG. 10. DRILLING AND REAMING REVERSE HOLE

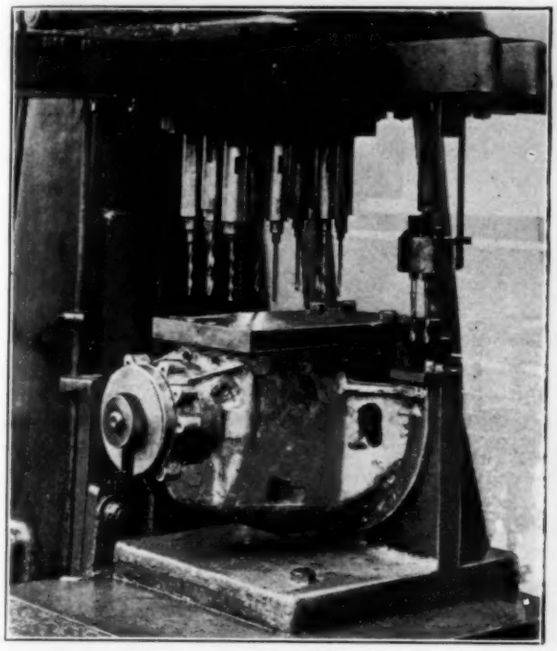

FIG. 11. MULTIPLE DRILLING TOP COVER SEATING.

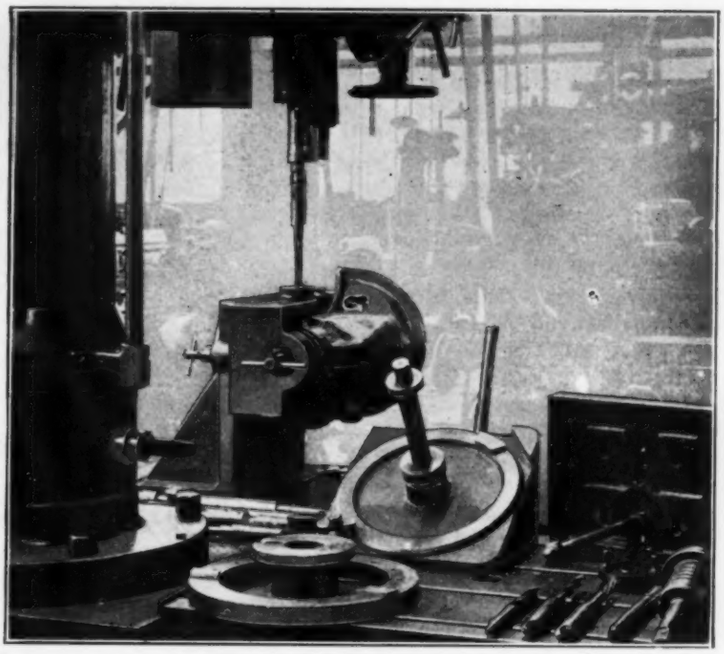

FIG. 12. DRILLING JIG FOR SPEEDOMETER HOLES, ETC.

gage of fixed height being used for setting the cutter. The milling head is brought down to this, with a 0.005-in. feeler interposed so as not to damage the cutter. The gaging position is of course not in line with the traverse of the cutter. A gage bearing on a finished surface on the fixture insures equal thickness of wall for each box and prevents the gears fouling when fitted.

Boring the Main-Shaft Holes

The next operation is subdivided into two, both done on No. 9 Herbert turret lathes. They are, respectively, boring for main shaft and turning flange, and boring and facing for the universal joint housing. The boring for main-shaft holes is shown in Fig. 9, the job being located on the three milled faces, resting against the base and being pinched in position by screws at the sides. The bars are set to cut the correct diameters, and the facing is done by the cross-slide. In the next lathe the same man takes the job and mounts it on a projecting mandrel, which takes a bearing in the two bores previously machined, the box being clipped to the plate of the fixture. A 4-ft. 6-in. Asquith radial drill is then used for drilling, reaming, counterboring and chamfering the lay-shaft hole, drilling and reaming the change-speed lever shaft holes and drilling, reaming, facing and chamfering the lock lever detent plate hole. Advantage is taken here of the side faces on the box, the job being located off the main bore by means of a plug, the reamer for the lay-shaft bore having to pass through the two webs mentioned in connection with the first operation. The holes for the sliding-selector rods are picked up by a plug on the main-shaft hole and an additional plug, with spring for the lay-shaft hole. The job is held only by these, the top of the main hole in the box being first bushed by a flanged bush for locking. To prevent seizing-up of bars and reamers, all pilot portions have wide and deep spiral oil grooves.

For the fourth set, also done on an Asquith radial drill, the operations are drilling, reaming and facing reverse-shaft hole, drilling two tapping holes, drilling, facing and tapping for filler hole, and drilling an oil-feed hole. For the first (Fig. 10) the jig locates by the main- and lay-shaft bores by means of plugs, the main hole being bushed as before. The two shafts are worked off in order to get the gear centers correct. The work is then moved to a rig at the front of the machine for drilling the two tapping holes, for which a contour jig only is employed, an expanding plug tightening in the bore and the jig being moved round to suit the shape of the casting. The hole for the oil feed is for the lay-shaft bearing and is part of the self-oiling system. The job is held in the main bores by a plug and a rotating jig is employed.

The next set of operations includes three drilling operations and two milling. The first one—drilling nine flange-holes—is done under a Fox multi-spindle drill. The job is held by a central bolt, being pushed

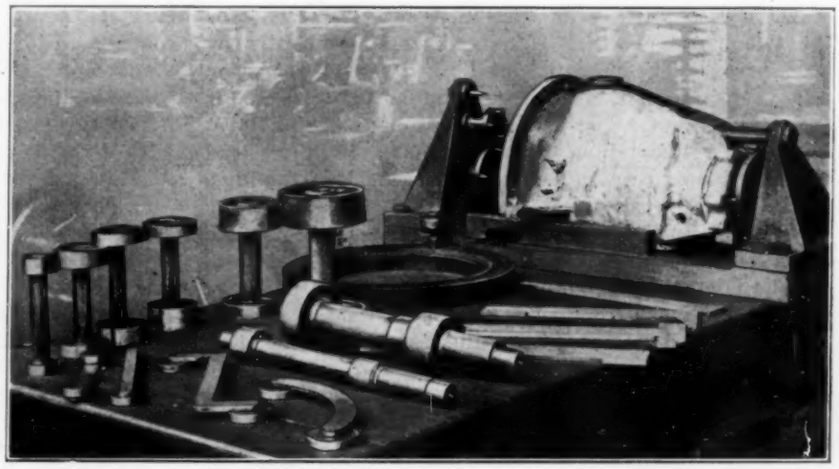

FIG. 13. GEAR BOX INSPECTION TACKLE

against the end locating face in order to get the holes in correct relation to the engine flange. The job is located in the bore by plugs and pushed round in the

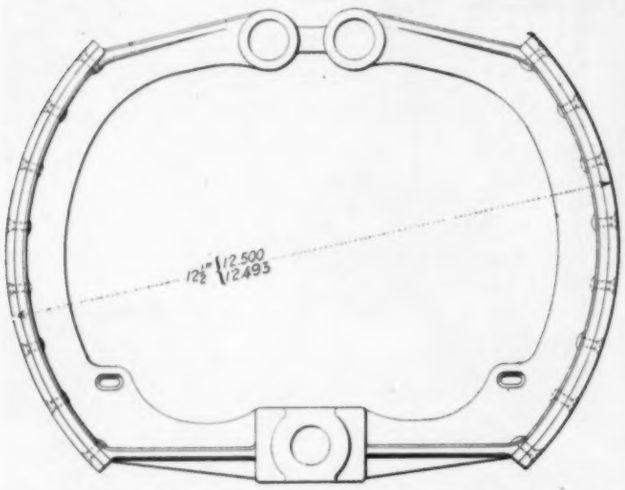

FIG. 14. BRAKE SHOE SUB-ASSEMBLY BEFORE HALVING

jig by screws bearing against foot-brake bracket faces. Next the holes are drilled in the top cover face (Fig. 11) and for the third drilling operation the multi-spindle Baush machine is used, the work being done in two sections, namely, drilling all holes in the universal joint housing flange and all holes in the primary housing face. The box is dropped into a base at the large end, with the drill plate registering in the joint ring housing and the lay-shaft bore, with a central bolt, gap washer and nut to secure. The second drilling operation for this is similar, the box being turned upside down and located roughly on the joint housing and held by a bolt. A drill plate at the top locates by the main and lay-shaft bores, this jig providing for the eight holes in the primary shaft housing face and in the lay-shaft face. For the two positions the machine is fitted with special star handles, one on each side.

Two milling operations are done on Brown & Sharpe machines and have for purpose respectively the surfacing of the lugs on the large flange for securing to engine and on the universal joint housing. The job is dropped on a circular table and located by the main- and lay-shaft holes and secured by a central bolt. The height of the cutter is again obtained by means of a setting face on the jig and the job is moved round by worm and wormwheel. Owing to the interference of the end web it is impossible to mill the faces for the two corner holes. This is done subsequently by spot-facing. The machine used for this sub-operation is a vertical miller, a horizontal miller being used for the next process. The job is located on the joint housing on a vertical plug in an ordinary dividing head which is indexed round for spot-facing back of the lugs.

The final operation on the gearbox consists mainly of drilling and facing holes, done under an Asquith radial, as shown in Fig. 12. A jig with horizontal spindle is employed for drilling two holes for the brake bracket on both sides and then a crosshole for the speedometer drive gear, as illustrated. Location is again by main- and lay-shaft bores, and a long pilot reamer is needed to bring the two holes for the speedometer driving gear in line. On a side table at the same machine is a rig for spot-facing the holes previously missed. Further, in connection with the oiling system for the universal joint housing, two holes are drilled on an angle, the box being placed on a suitable angle plate and swiveling against two stops for the two holes. The drill is guided by a plate positioned off a key in the central locating bar. When the spot-facing has been done a peg hole is put in to prevent moving of the joint housing. For the fourth operation here, namely, drilling and tapping the drain hole, the job is simply bolted to an ordinary standard angle plate.

The job is finally moved to an Archdale sensitive radial drill adapted for tapping, the box being placed in a jig and all holes tapped by a rotating fixture except the filler and drain holes.

The section inspector then tests the box for every operation, checking the centers, etc., and also finally checking the whole box before it goes to the finished stores. The section viewer can pick up any job at any operation. In particular the drilling of centers for shafts is examined carefully, but generally the jigs and operations will show whether the job is working out properly, a jig rapidly locating a fault. Otherwise the only supervision is that of discipline. Finally, every gearbox is tested for the distance between the centers of the main and lay shaft by high- and low-limit plugs, the tolerance allowed being 0.003 in. Before machining the castings are checked by rough viewing apparatus to insure that they will machine out properly, the job simply being placed on a faced slide and plugs carrying centers being pushed in position to test the casting. Fig. 13 shows the rig for a finished box, a similar one being used for the rough box.

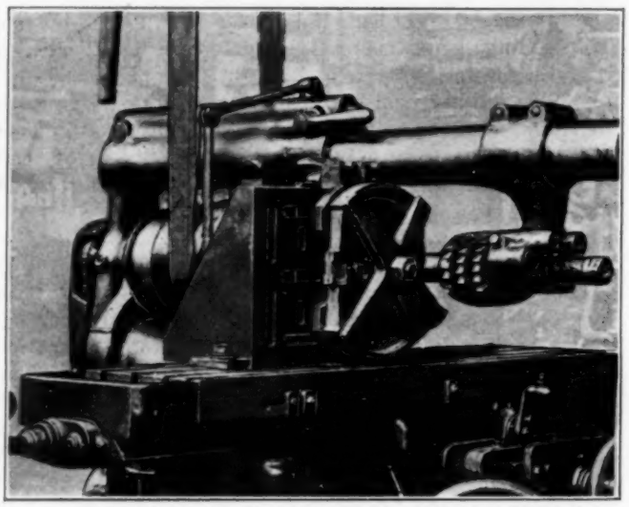

FIG. 15. GANG MILLING FULCRUM AND CAM HOLE LUGS

The brake shoes are shown in Fig. 14, the two halves being cast in iron in one piece. The first operation is to straddle-mill (Fig. 15) the fulcrum and cam-hole lugs in a Brown & Sharpe horizontal machine, using an indexing fixture giving two positions. Three cutters produce the two gaps necessary. The machine is worked between two stops for the two positions and the job is held against a vertical face, as illustrated, and indexed round. For the second operation, drilling and reaming three $\frac{13}{16}$-in. holes in a pillar drill, the job is put down on the machined faces on a circular-plate jig, roughly held on the diameter, and located by the two boss contours, a quick-release chuck being used for drilling and reaming without stopping the machine.

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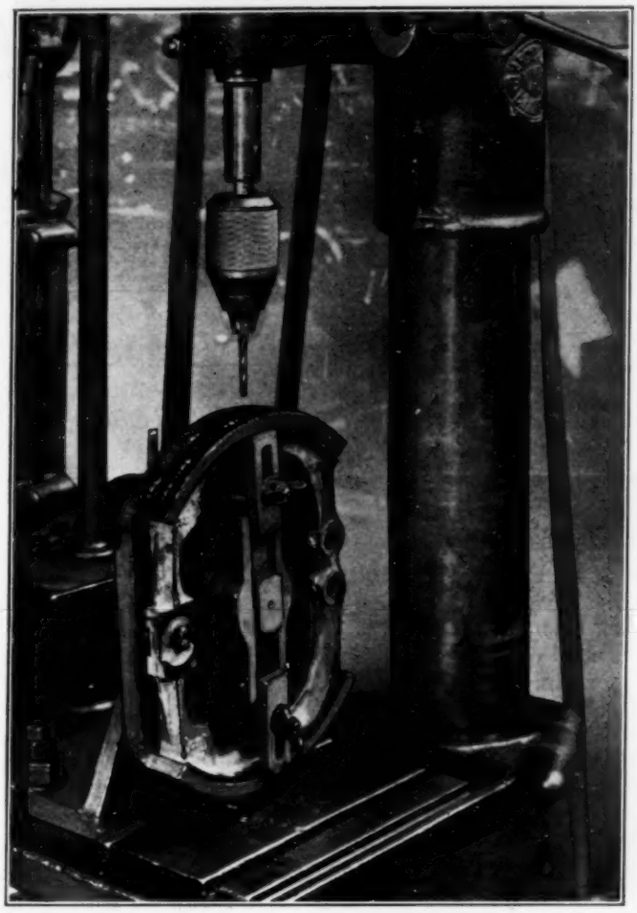


FIG. 16. DRILLING RIVET HOLES FOR BRAKE LINING

stan lathes, the job is secured by straps to three pegs on a faceplate fixture and turned on the outer diameter. The cross-slides are used for roughing and finishing the sides, the rough scale on the diameter being removed by a single-point tool on the cross-slide and this surface finished by the turret. Duplicate machines are needed as this process takes twice the unit time of the section operation. Next, for drilling the rivet holes for the Ferodo (brake) lining a turntable jig is employed, in the form of a vertical plate with flange turned inside to suit the brake diameter, the job being clipped as shown in Fig. 16. The jig moves across the table for the two sets of holes needed, the total number of holes being twenty. The brake lining is fitted and riveted as the work progresses, the work being undertaken by the same operator, who has a clamping piece which presses the Ferodo and shoe tightly together. A machine has been tried but hand work is quicker. The shoes are then split on a horizontal miller, Fig. 17. Two sets of cutters are used of varying widths, the job being swiveled by an eccentric device from one to the other. The final operation on the brake shoe is to mill a slot to suit the brake cam. A duplex fixture is employed to hold one piece on each side of a central wall, the job being located on one of the drilled holes and bedded down on its own diameter, the pressure of the cut being taken by setscrews. Two half shoes are milled simultaneously, the cut being taken across.

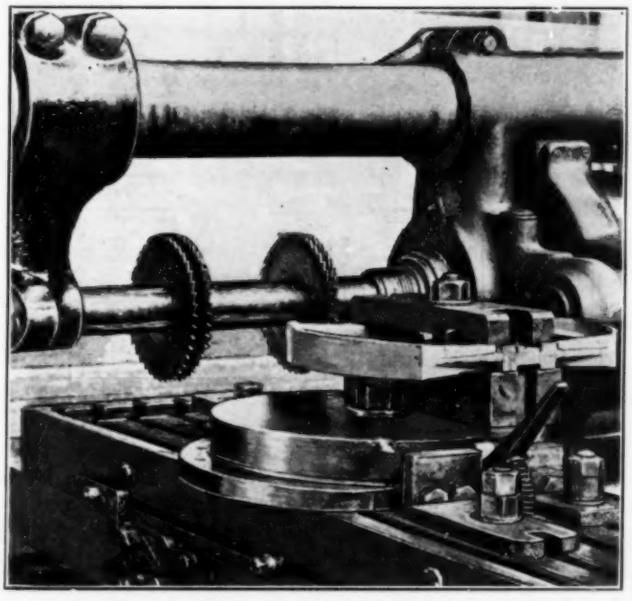
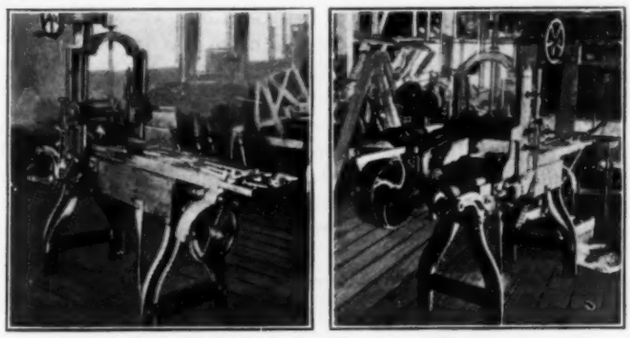


FIG. 17. SLITTING BRAKE SHOES WITH ECCENTRIC FIXTURE

An Old Screw Planer

BY MILTON WRIGHT

The illustration shows front and back views of a small screw planer that evidently dates from the early days of the machine-tool industry. The movement of the platen is obtained from a very coarse pitch screw that, in turn, is driven by the arrangement of bevel gears shown in the back view. A single belt drive is used, the belt passing across an idle pulley at each shift, and driving the screw first in one direction and



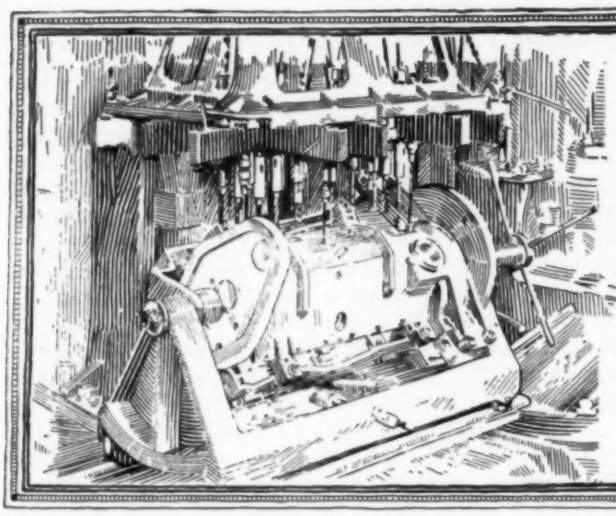
AN OLD SCREW PLANER

then the other by reason of the fact that the bevel pinions are located on opposite sides of the screw. The higher rate of return speed is provided for by properly proportioning the ratio of the bevels.

The crossrail has a single elevating screw located at the center of the housing. The feed rack and pawl are on what would seem to be the wrong side of the machine, while the table reverse is on the other side where it should be; thus making it a rather unhandy machine to operate, as a man could hardly be expected to be on both sides at once.

The large spur gear shown in the front view is driven by a pinion on the end of the screw and is keyed to the end of a shaft that passes nearly to the other end of the machine, where it operates the train of gears that constitutes the feed works.

At some period of its career the machine evidently had been found too unstable to resist the shock of table reverse and the twisted braces of iron had been added at each end to steady it. The machine was built by H. Gage, Nashua, New Hampshire.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Design of Profiling Fixtures—Principles Involved—Types of Profiling Machines— Cam Milling—Irregular Forms—Methods of Roughing and Finishing—Multiple Fixtures

THE cutting of irregular forms is generally done on a profiling machine or a cam cutting machine. In the manufacture of rifles, pistols, sewing machines, and many other small mechanisms, these machines are used to produce parts which would be difficult to make by any other process. The cutters used for this work are milling cutters of various forms to suit the particular piece of work to be manufactured. Profiling machines are, in fact, nothing more than milling machines so arranged that the tables or spindles can be moved freely in any direction. In some cases the table moves in two directions while in others the table is moved in one direction and the spindle in another. Several types of profiling and cam cutting machines are shown diagramatically in this article in order to familiarize the tool designer with the general principles on which they work. It must be understood that these diagrams are intended only to show principles and are not by any means construction drawings of the machines.

Bench Profiling Machine

Fig. 161 shows a type of bench profiling machine very useful for small light work. The machine consists of a base and column *A* on which is mounted an adjustable slide *B* carrying a spindle *C*, at the lower end of which, at *D*, the cutter is located. The table *E* is so arranged that it has two movements at right-angles to each other, one of which is obtained by means of the lever *F* while that in the other direction is obtained by means of lever *G*. The work is mounted on the table at *E* and a suitable former is placed in relation to it in such a way that a former pin can be placed in either of the holders at *H* or *K*. The head can be lowered to the correct position by means of the lever *L*.

Provision is made at the rear of the head so that different heights of work can be accurately machined by placing suitable blocks between the adjustable points indicated at *M*. This type of machine is very convenient and does not take up much space.

For the majority of work to which a profiling machine is adapted a single cut is sufficient to produce it within the required accuracy, for which a single spindle profiling machine such as that shown at *A* in Fig. 162 can be used. When work is to be roughed and finished it is sometimes desirable to use a two-spindle machine similar to that shown at *B*. In general construction these two machines are similar, the difference between them being in the number of spindles and former pins utilized.

In the example *A* the table *C* is moved in one direction by means of the handle *D*. The handle *E* moves the head *F* which contains the spindle *G* and the holders for the former pins at *H* and *K*. A lever is provided at *L* to raise and lower the slide *F*. When work is handled on this type of machine, the former can be placed either at the right- or left-hand side of the cutter spindle, according to the nature of the work and the fixture that is being used.

The two-spindle machine shown at *B* is identical in general form with that previously described, excepting that there are two spindles *M* and *N* on this machine and three holders having former pins at *O*, *P* and *Q*. When work is to be roughed and finished in the same fixture, two former pins can be used and a suitable allowance made in setting the pins to provide for the amount of finish required.

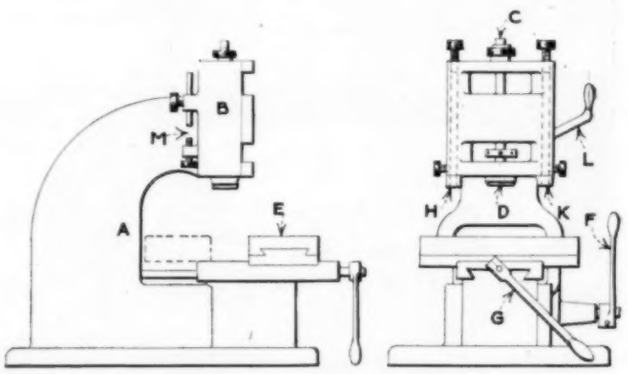


FIG. 161. TYPE OF BENCH PROFILING MACHINE

It is well to call attention to the fact that the spacing of former pins in relation to the spindle on profiling machines is a fixed dimension as indicated at *X*. Hence all fixtures must have the work and former plate located in accordance with this dimension. When roughing

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and finishing cuts are to be taken the allowance between the two cuts is determined by raising or lowering one of the pins.

Cam-cutting Machines

Cam-cutting machines belong to the same classification as profilers, although they are usually arranged so that their operation is automatic instead of by hand. Two diagrams of cam-cutting machines are shown in Fig. 163. *A* shows a general diagram of one machine having two tables, *B* and *C*, on the first of which the former plate is mounted, while on the second the work is clamped in place. The two tables are geared so that they revolve in unison and it is therefore evident that the spindle *D* will follow the form controlled by the pin *E* which can be adjusted along the slide *F*. The weight *G* attached to the carriage *H* keeps the former pin in contact with the former at all times. The action is automatic after the work has been placed in position. By means of suitable attachments, either flat or cylindrical cams can be cut in this type of machine.

Another machine for cutting cams of either cylindrical or plate variety, is shown at *K*. In this case

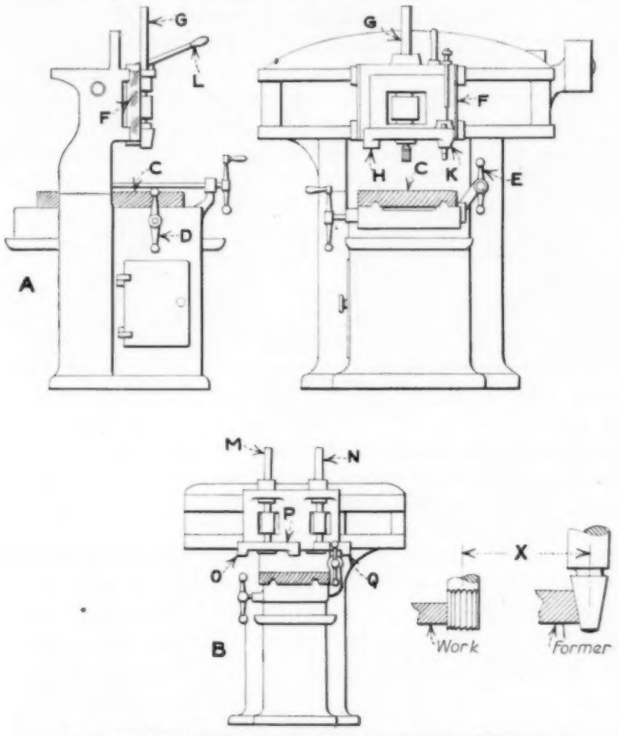


FIG. 162. DIAGRAMS OF ONE- AND TWO-SPINDLE PROFILING MACHINES

a roller or former pin is placed at *L* so that it remains in contact with the master cam *M* while this is revolved. The revolution of this cam causes the slide *N* to move up and down according to the shape of the master cam. The work *O* is suitably mounted so that it will revolve in unison with the master cam. It is evident that the cutter *P* carried in the slide *N* will be controlled so that it will reproduce a form according to the contour of the "master" used. This machine can be adapted for cutting a plate cam by the use of attachments.

Design of Profiling Fixtures

In general design a fixture for profiling is one of the simplest, and yet it is very easy for an inexperienced designer to make serious errors, unless he is familiar with the general principles involved in the use of profiling machines. Several important points are given herewith.

(1) General shape of the work. It does not always follow that because a piece of work is irregular in shape it is more profitable to profile it, as it may be found a better production proposition to mill it with a formed cutter. Careful analysis must be made before reaching a decision as to the most profitable way to handle the work. (2) Accuracy required. If a piece of work is to be held within very close limits it is possible that two profiling cuts may be necessary in order to keep it within the required tolerance. If the work is to be hardened and ground, these points must also be taken into consideration and suitable allowances made. (3) Location of work. Provision should be made for locating any work which is to be profiled by drilling and reaming suitable locating holes or by providing other means according to the contour of the work to be machined. When a number of pieces of the same general shape are to be profiled, a single fixture may sometimes be adapted to handle all the work, providing that a standard method of locating is used and that the former plates are made interchangeable.

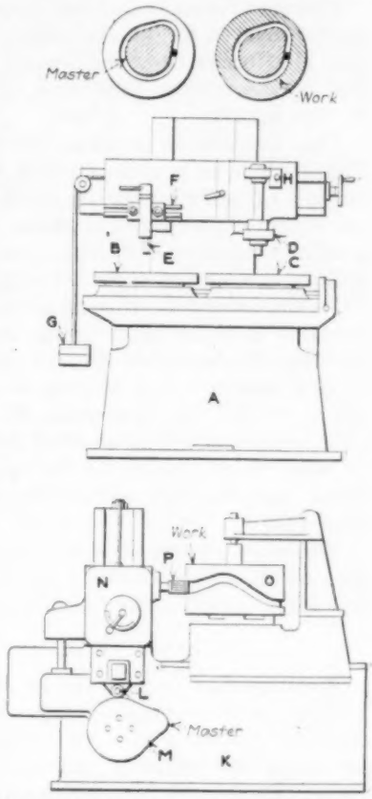


FIG. 163. DIAGRAMS OF TWO AUTOMATIC CAM-CUTTING MACHINES

(4) Position of work. As practically all profiling machines have a fixed relation between the cutter spindle and the former pin, and as the height to which the head can be raised is limited, it is evident that the designer must be careful to keep within the dimensions specified and make suitable allowances so that the work can be removed and replaced without difficulty. Profiling fixtures are usually built very low on account of the limited head movement permitted.

(5) Chip accumulation. Care must be taken in the design of fixtures to see that the former plate is so placed that chips will not get into a pocket and cause inaccuracy in the work. If a slotted plate is used as a former, suitable openings must be provided so that chips can be cleaned out from time to time as they accumulate.

Forms of Profiling Cuts

A number of conditions are possible in profiling: (a) There may be a plain simple form on one side of a piece of work; (b) it may be required to cut an irregular form completely around a piece of work; (c) a more or less irregular slot may have to be finished on both

sides and this slot may be continuous or it may be interrupted—it may be circular or angular; (d) the inside of a piece of work may be of such shape that it must be profiled to a given form; (e) a series of bosses or surfaces of various heights may require facing.

There are also occasional peculiar cases which cannot be covered by general notes, but when problems of this kind occur they can usually be solved by application of the various principles which will be mentioned in this article.

Fig. 164 shows several varieties of profiling cuts. The work *A* is a plain surface which is to be profiled instead of milled because there are protuberances on the casting which would make it inconvenient to use a milling machine. Furthermore, the cost of a vertical milling machine suitable for work of this kind is much more than the cost of a profiler, and therefore greater economy is obtained by using the latter machine. The example *B* illustrates step profiling in which the surfaces *C* and *D* are to be held in a fixed relation to each other so that the dimension *E* will be within certain limits. In machining work of this kind the profiler can be used to advantage by the application of a suitable block between the points noted on the diagram in Fig. 161.

The work shown at *F* is a plate which is to be profiled inside as indicated by the finish marks. Work of this kind is frequently found in general manufacturing.

Examples of Surface Profiling

Work similar to that shown at *A* in Fig. 165 can be handled to advantage on a profiling machine. In this case the bosses *B* are so arranged that they cannot be faced conveniently on an ordinary milling machine. On a profiling machine the work can be held in a fixture similar to that shown at *C* and the cutter slide can be locked so that it will remain at a certain height. The operator can very rapidly pass over the various bosses with a cutter as indicated. A simple type of fixture can be designed so that the work locates on the finished surface *D* and is clamped against the locators at *E* by means of the swinging clamp *F*. Many cases similar to this are found where the profiler can be used to advantage. No forming plate is necessary, as the operator controls the movement of the cutter by means of the handles on the machine. In certain cases it may be advisable to provide a guard plate to prevent an accidental movement of the handle which might cause the cutter to gouge into the work, but in most cases this is unnecessary.

Step Profiling

The profiling machine is particularly useful where several different heights are to be machined on a casting. A case in point is shown in Fig. 166. In this case the work has been previously machined at *B* and the hole *C* has been drilled and reamed. It is necessary

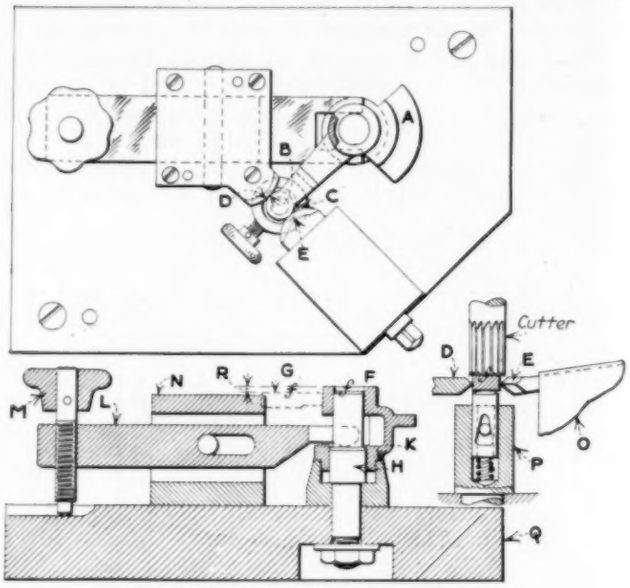


FIG. 167. PROFILING FIXTURE FOR A DELICATE OPERATION

to face off the bosses *D*, *E* and *F* so that they will bear a certain relation to each other. The work is set up on a fixture locating on a plug *C* having shoulders at

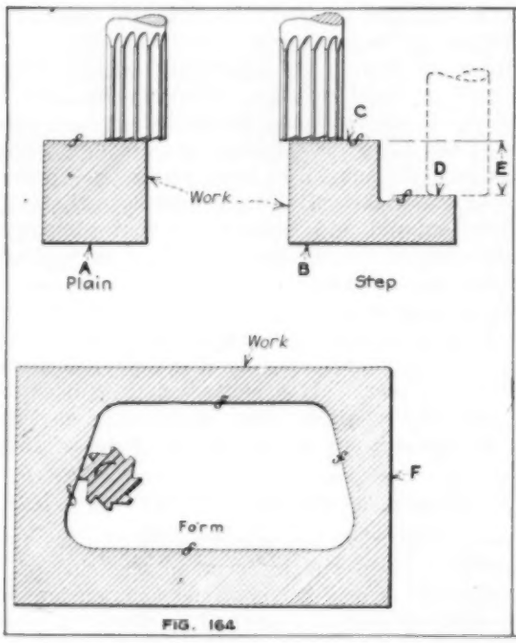


FIG. 164

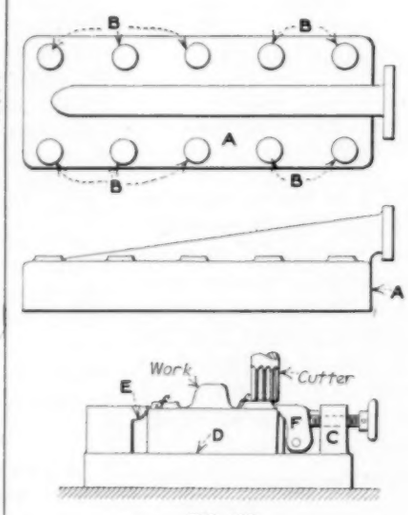


FIG. 165

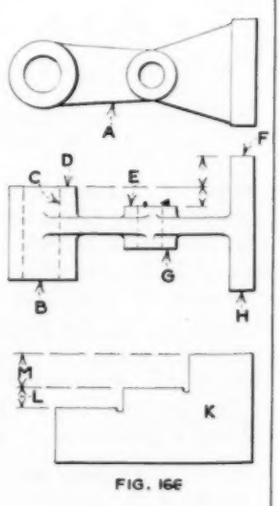


FIG. 166

FIG. 164. SEVERAL FORMS OF PROFILING CUTS. FIG. 165. SURFACE PROFILING. FIG. 166. STEP PROFILING

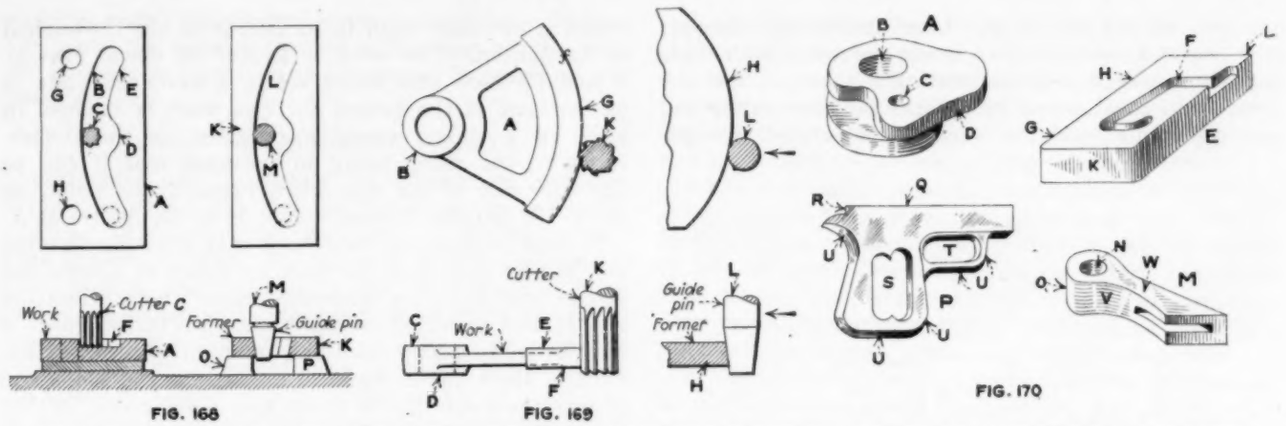


FIG. 168. FIG. 169. FIG. 170.

FIG. 168. SLOT PROFILING. FIG. 169. CIRCULAR PROFILING SHOWING METHOD OF ADJUSTMENT USED FOR ROUGHING AND FINISHING. FIG. 170. EXAMPLES OF SHAPES SUITABLE FOR PROFILING

B. Suitable adjustable supports are also provided at points *G* and H and the work should be clamped in such a way as to not interfere with the cutter. In milling the various surfaces a step-block can be used like that shown at *K*. The various shoulders are obtained by using the setting as indicated at *L* and *M*.

In the first article of this series Fig. 7 showed an operation sheet on the part *A* indicated in Fig. 167, and it will be noted by a reference to this sheet that the second operation consisted of surfacing the small end *F* to length and milling one side of small arm *G*. The work is located on a stud *H* and against the previously finished surface *K*. A sliding clamp *L* operated by the thumbscrew *M* straddles the locating plug and clamps the work down firmly. This sliding clamp is located in a block *N* which has a knife-edge on one side as indicated at *D*. The side of the boss *B* is forced against the point mentioned by means of the knife-edge clamp shown at *E;* this clamp being similar in construction to one which was illustrated and described in a previous article. The action at this point is shown clearly in the detail view at *O*. A light spring jack support is used at *P* under the arm *B*. The base of the fixture *Q* is so arranged that it can be fastened with screws to the table of the profiling machine.

When using this fixture the dimension *R* is preserved by using a size block to regulate the difference between the two cuts. This piece of work required extreme accuracy and the fixture shown was designed with great care in order to preserve the relations of various surfaces to each other.

Slot Profiling

When an irregular slot is to be profiled it is not advisable to use a cutter exactly the size of the slot which is to be machined. Much better results will be obtained by using a smaller cutter so that each side of the slot will be milled separately. The advantage in using this method is that the cutter diameter need not be held accurately to size, slight variations being compensated for by adjustment of the former pin. In slot profiling it is evident that the cutter must always be smaller in radius than any corner or fillet that is to be profiled. A sharp inside corner cannot be profiled, but it may be cut to the radius of the cutter and afterward broached, shaped, or filed, according to circumstances.

An example of slot profiling is shown in Fig. 168. In this case the work *A* must be machined on the sides *B* and *E* and the recess *D* must also be profiled. The work locates on two dowel pins at *G* and *H*, and is clamped in place by means of ordinary strap clamps which should be so arranged as not to interfere with the action of the cutter. The slot does not extend entirely through the work but is shallow as shown at F. The former pin *M* controls the movement of the cutter *C* as it is guided along the slot *L* in the plate *K*. This plate is mounted on bosses at *O* and *P* so that chips will not accumulate in it and thus cause inaccuracies in the work. Openings at the sides allow the chips to be readily cleaned out as they accumulate.

Circular Profiling

It is sometimes more economical to profile a segment of a circle than to machine it on a lathe, because the lathe operation would be an interrupted cut. An example of this kind is shown in Fig. 169. The work *A* has been previously finished in the hole *B* and also on the sides *C*, *D*, *E* and *F*. The radius *G* is to be cut in this operation and the cutter *K* leaves a small amount to be removed by the hob when cutting the teeth. This amount can be regulated by the position of the former

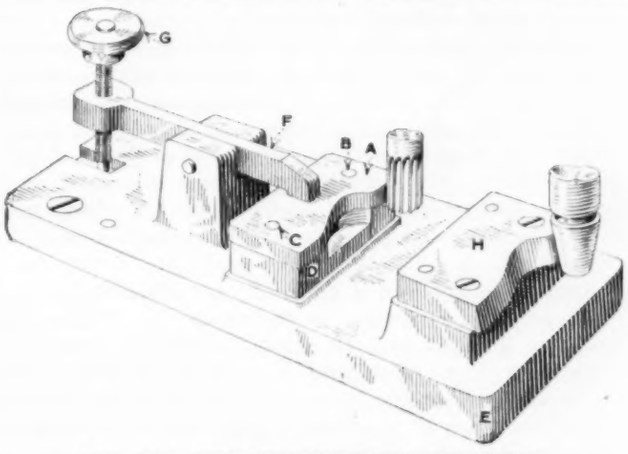


FIG. 171. EXAMPLE OF WELL DESIGNED PROFILING FIXTURE

pin *L* in relation to the former *H*. This method allows the operation to be accomplished much more rapidly than it would be if done on an engine lathe or other similar machine.

Examples of Shapes Suitable for Profiling

Fig. 170 shows a variety of work requiring profiling operations. The cam *A* is to be profiled on the surface *D*. It has been previously bored and reamed at *B* and

the locating pin hole *C* has been drilled and reamed; it is therefore necessary to locate the work both from the center hole *B* and the locating pin hole *C*, and the clamp used must be of such form that the cutter can pass entirely around the work. The natural arrangement for clamping a piece of work of this kind would be by means of a C-washer and nut.

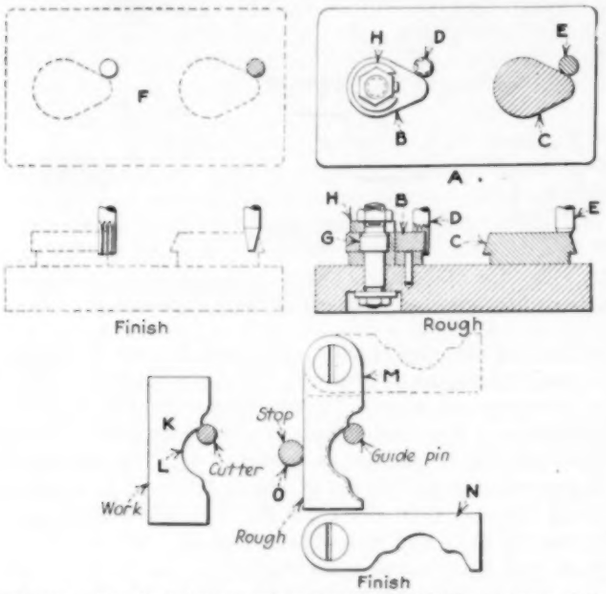


FIG. 172. DIAGRAMS ILLUSTRATING METHODS USED FOR ROUGHING AND FINISHING WORK ON PROFILING MACHINES

The work *E* is a special cam plate having an irregular slot in it as indicated at *F*. As this piece has no pin holes on which it could be located, it would be necessary to provide other means of assuring correct location. A natural method would be to place locating studs at the points *G*, *H* and *K* and force the work into position by means of a screw or clamp at *L*. Methods of clamping have been described which could be applied to this piece of work without difficulty.

The pistol frame shown at *P* is an excellent example of a piece of work which requires several profiling operations. The work is located against the finished surface *Q* and also at *R* by means of pins. The operations to be done are profiling of the slots *S* and *T* and the outline *U*. This work can be done by means of a multiple fixture on an automatic type of profiling machine, the fixture for which will be described later in this article.

Another example of a piece of work requiring a circular profiling operation is shown at *M*. This piece has been finished on both sides and the hole has been reamed at *N* so that good location is assured. The operation to be done is the profiling of the round portion *O* and the sides at *V* and *W*. There should be no difficulty in designing a fixture for this piece of work as good locating points can be easily obtained and suitable clamps can be applied without trouble.

Well-Designed Profiling Fixture

Due to the fact that profiling fixtures are so similar in their general construction, the writers have not attempted to show many designs in this article as many of the principles of clamping and locating that have previously been described can be easily applied to the design of profiling fixtures.

Fig. 171 shows a very clean-cut design of fixture which is not only rapid in its operation but economical in its upkeep. The work *A* locates on dowel pins at *B* and *C*, these pins being set in a hardened plate *D* on the base of the fixture *E*. The work is clamped in place by a sliding clamp *F* operated by the thumbscrew *G*, the clamp being so arranged that it can be slid back out of the way when replacing or removing work. A suitable former is applied to the fixture at *H*.

It may be well to state here that profiling fixtures are usually located on the table by means of dowels and screws and there are occasional cases where a locating slot is also provided on the table. Factories where a number of profiling machines are used generally standardize their tables both in regard to the slots and also in their relation to screw and dowel holes, so that fixtures made for profiling can be changed from one table to another. A suitable jig is also provided in order to make sure that the hole locations are correct.

Methods Used for Roughing and Finishing Work

The diagrams in Fig. 172 illustrate several methods which can be used when it is necessary to rough and finish a piece of work at the same setting. At *A* the cam *B* is to be machined, using the former *C* to obtain the correct contour. The cutter and former pin are indicated respectively at *D* and *E*. A two-spindle profiling machine is used for this work, the sliding head of the machine being brought over for the second operation so that the work takes the position shown by the dotted lines at *F*. The sectional view shows the method of locating the work *B* on a stud *G*. The C-washer *H* is used for clamping.

Occasionally a two-spindle profiling machine is not available for doing both roughing and finishing operations on a piece of work. A method which can be used for a case of this kind is shown below, where the work *K* is to be profiled at *L*. It is easily possible to arrange two forming plates such as those shown at *M* and *N* so that they can be successively swung into the position indicated against the stop *O*. These forming plates can be identical in size or they can be made

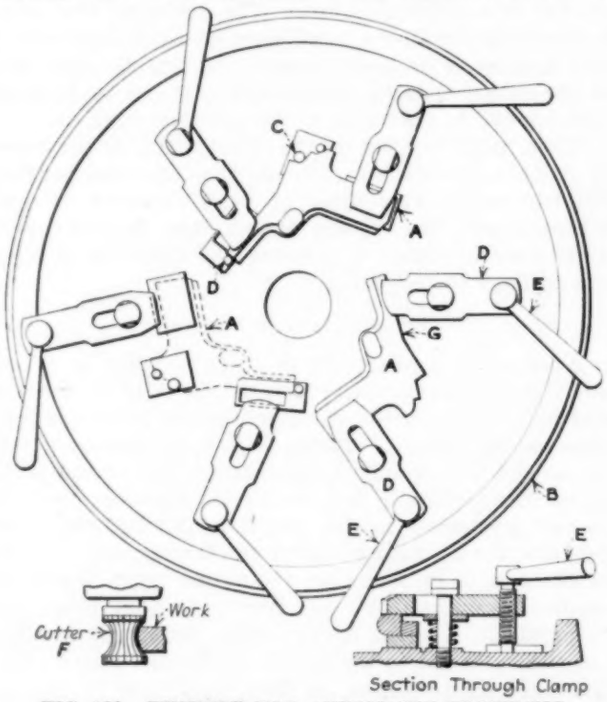


FIG. 173. FIXTURE FOR AUTOMATIC PROFILING

so as to allow the required amount for finish. If they are made the same a vertical adjustment of the head can be made to take care of allowances in roughing and finishing cuts.

Fixtures for Automatic Profiling

Economies can frequently be effected in profiling operations by using a multiple fixture on an automatic profiling or cam-cutting machine. A fixture of this kind is shown in Fig. 173, the work being an automatic pistol frame, shown at *A* in the illustration. Three pieces are set up on the faceplate *B* which is of special design having a rim around it which serves as a pan so that cutting lubricants can be used, the lubricant running off through a hole in the center of the table. A wire basket catches the chips and allows the lubricant to percolate through and return to the pump.

The type of machine on which this fixture was used is a Pratt & Whitney automatic profiling machine. The former plate which is generated on the machine from a model of the work, is fastened to the under side of the fixture. It is not shown in the illustration.

It will be seen that each of the parts *A* locates against pins at *C* and *D*, these pins being located in hardened supporting plates. The work is held by the sliding clamps *D*, the binder handle *E* being used to pull back the clamps. The construction of these is clearly shown in the sectional view. The cutter *F* used in this operation is formed in order to produce a rounded surface on the work as shown in the detail view. In order to show the method of clamping and locating more clearly, one of the parts *A* is indicated by dotted lines and the clamps are shown removed from the work.

Another fixture, of a similar kind but holding 4 pieces instead of 3, is used for the next operation which consists of forming the surface *G*. This fixture is not shown but it may be stated that the work is set up so that the four surfaces *G* form the sides of a square inside of which the forming cutter operates. Fixtures can be designed for automatic profiling when the work is of such a nature as to permit setting up to advantage. Certain forms are more adapted to these machines than others and the adaptability of various machines should be considered before attempting to design fixtures for profiling.

A Movement for Sound Industrial Relations

The Merchants and Manufacturers Association of Los Angeles, Cal., in support of its slogan, "Los Angeles Straight Ahead via Sound Industrial Relations" has recently issued to its members a bulletin on "placement" embodying the following suggestions and principles:

1. Men affected should be given all of the notice possible. A month is none too long—a week is the minimum that is decent. Every man must be given every possible opportunity to adjust himself to changed conditions.

2. In every case be dead sure that any action you may take is absolutely justifiable, necessary and based upon sound judgment rather than momentary expediency.

3. Explain to each and every man affected, in personal conference with him, the causes, the reasons, the future outlook and your regret that such action on your part is necessary. Don't use bulletins or pay envelope notices. They are peremptory and are thoroughly objectionable.

4. Ask each man how he would handle the situation if he were in your shoes. Consult *with* him. You may get some valuable and helpful suggestions—it has happened many times—and at any rate you will have the satisfaction of knowing that you are playing square and practicing sound human engineering.

5. If a man has been in your employ, it should be evidence that he is at least a fairly good man. If you must lay him off, thank him personally for the service he has rendered you and give him a letter of appreciation, explanation, commendation and recommendation that he may use in securing employment elsewhere. Such a letter pleases others as it would please you.

6. Send him to the Industrial Relations Department of the Merchants and Manufacturers Association. The Industrial Relations Department will do its best to help him to get a job. That's one of the functions of the department.

7. We believe the above recommendations constitute sound industrial relations—it is the newer philosophy and method in labor matters. We *talk* a lot about it all. Here is a chance to *do* some of it. It *pays* and pays *big*.

The High Cost of Talking

By John H. Woodhull

It has been a convention that conversation has been accepted and paid for as a companion of labor. Few employers care to run a jail and forbid all conversation between whistle blows. But there is indubitably a point at which the employer is justified in seriously considering how much irrelevant conversation between employees he can afford to pay for. It is coming to be agreed that employers cannot afford to pay for conversation between an employee and friends who share his society but not his labor. And to this end is the rule excluding visitors from factories firmly enforced.

For the rest, most employers prefer that enlightened self interest shall guide the employee to a realization of the high cost of mere talking. While foremen and executives are sometimes beguiled into making conversation, the continuance in positions requiring activity in responsibilities precludes the possibility of indiscriminate surrender to the lure.

Life is a training school—and all too few are the opportunities for advancement and usefulness. The man or woman of good intentions cannot fail to be sensitive to those things that interfere with the objects of life. It is a truism—albeit we must iterate and reiterate it—that man created for a good purpose has no right to waste any of the gifts with which he is endowed.

It is the worst sort of crime against one's self to stay with a job that offers no future; in which one is so uninterested that mere talk unnoticed by the boss can be mixed as an essential component.

The tongue of man and tail of dog—each wags when the owner is happy. It would be well if the tongue like the tail ceased wagging under different temperamental conditions.

There is no need to enlarge on the evils attendant on jealous, envious and malicious language in business. How great are the losses due to irritation at passing remarks the most perfect cost system can never measure.

Talk is a currency with which rich and poor are abundantly supplied; but with which no one can afford to be extravagant.

Organization and Management of the Small Shop

III. Methods of Market Analysis—Different Ways of Reaching the Ultimate Consumer—Importance of Establishing a Definite Sales Policy

By ELMER W. LEACH

MANUFACTURERS made a significant stride forward in the advancement of industry when they convinced themselves that factory production should be predetermined. The old idea was to place with the foreman or the superintendent the responsibility of seeing that the men were kept busy and that the work was turned out.

No special effort was made to see that different parts went through the shop in the proper proportionate quantities. There was no attempt made to figure ahead so that a man could know before he was finished with one job what his next job was to be. No one seemed to realize the possibility of being able to base future plans on past performances.

But now, in all modern plants, whether they be large or small, those conditions do not obtain. Toward the close of the year the management decide what the production during the next year shall be, and the superintendent, or whoever may be in control of factory management, arranges a definite schedule to provide this production.

He knows just how many men he will need. If his equipment is inadequate, he knows just where he must add new tools so that the work will go smoothly through each department. Castings are ordered from the foundry, raw materials from outside sources, and parts are put through the various processes and operations according to a definite plan of routing; so that the assembly departments will receive all materials in proper proportionate amounts.

The machine work on each part is divided into certain definite operations, and records are kept of the machines on which each operation should be performed. The time for each operation is also carefully figured and tabulated.

By means of such methods as these the work can be routed through the plant, to each department and even to each machine, for weeks in advance, and necessary requirements of men and materials anticipated well ahead of the time they are needed.

This is planning production. It is scheduling the output of a shop. In some large plants entire departments are necessary to do this work. In small shops it should be done just as carefully and as accurately though the systems used need not be so elaborate.

Until a few years ago, managers thought they had reached the height of possibility in predetermining business requirements; but each year sees an increasing number of firms who exercise the same care in studying probable sales that they do in planning future output.

This is an unusual condition, for it has always been supposed that because sales are to a certain extent beyond the control of the seller, they cannot be estimated to any degree of accuracy.

But recent market surveys by sales managers show that not only can sales of a product be predetermined each year with surprising correctness, but the probable sale of a new article can be investigated in the same way and with the same profitable results.

In investigating the market for your product you must make a note at the very start to distinguish unmistakably between *fact* and *fancy*. It is proven indisputably by the experiences of others that it is of extreme importance that you have a definite plan for merchandising your goods. In studying the methods of others and arriving at the best probable method for yourself, be guided always in your analyses by the *facts*, and give secondary importance to opinions and theories.

Of course, you will want to give due consideration to the opinions of successful business men who may offer to assist you in analyzing your marketing problem, or whose thoughts on that subject you may read in some book or trade magazine. But their opinions will be based on statistics from their own business careers; so that when they suggest a certain safe course for one embarking in business, it will probably be the course which they adopted, and which later results showed to be a sound one.

When I suggest that you be wary of theories and opinions I do not mean to discourage you from devoting as much time as you can to a study of what big business men have to say on the subject of merchandising. But I do mean to guard you against trying to determine your sales policies by simply sitting around a table and having each one say, "I think it ought to be done this way."

The moment you find yourself and your associates trying to arrive at a decision in that way you should adjourn the meeting until a later time when you can have some real data on which to base your judgment. If you do not, you will be a mere debating society, not a group of business men dealing with problems in a business-like way.

Selection of Territory for Distribution

The first step toward ascertaining the market for your product is a study of the territory in which you will extend your sales efforts. Your own geographical location will have a certain limiting effect on the extent of your distribution. Obviously, you are most fortunately located for national distribution if you are in the central part of the country.

There are some products, a great many more than one would at first suppose, which because of their very nature cannot enjoy national distribution. Machinery for the cotton industry would have only the Southern states for its territory, farm products would not sell in New York City, nor would a machine for laying pavement interest those in the rural districts.

Most products, however, can be distributed throughout the entire country if your capital and your production will permit that territory.

You must bear in mind the carrying charges on your goods. Unless your goods are very superior to similar goods made in other sections of the country you cannot expect that users in those sections will pay high freight rates and wait several weeks for deliveries. So if you plan to cover the entire country, it will be necessary for you to present special reasons why people in some sections should prefer your goods.

One good way to determine the size of your territory is to study the mailing lists of addressing companies. These houses will gladly send you their catalogs, and such books contain a vast fund of information that is not only interesting but possible of profitable application. Even though you may plan to market your product throughout the entire country, it is very unlikely that you will cover that entire territory at the outset; it is almost certain that such a policy would be unwise.

Analyzing the Market

Just as you must try out your product by actual tests, so you must experiment with your territory in the same way. If there are 50,000 persons or businesses in a certain state that you may believe are good prospects for your goods, do not start right off with a bang by sending literature out to that entire group. Pick any 1,000 names at random and try your advertising on them. Give them a fair chance, and if the results do not justify the effort, you will know that the other 49,000 will probably be the same.

These mailing lists will enable you to select the states or districts best suited for your initial sales efforts. In the catalog of the Ross Gould Co. of St. Louis, for example, we learn some very interesting facts about possibilities of certain states in certain lines. The following table will illustrate this.

	Georgia	New Jersey	Oklahoma	Washington
Auto owners	103,000	141,500	105,000	120,870
Farmers owning autos	39,580	35,815	61,083	44,779
Truck owners	6,855	20,500	6,000	9,550
Motorcycle owners	1,050	11,300	1,700	6,100
Ford owners	49,144	48,270	51,960	48,470
Garages	1,684	2,505	2,460	1,817
Auto dealers	871	1,427	1,612	731
Ford dealers	129	161	159	140
Truck dealers	45	190	70	100
Accessory manufacturers	6	124	2	11

Here we have four states in different sections of the country which have approximately the same number of automobiles, and in each state about half the cars are Fords. The Ford dealers, too, are pretty evenly divided so that each dealer has sold between three hundred and four hundred cars on the average.

In Oklahoma there are twice as many farmers owning automobiles as there are in New Jersey, and yet in New Jersey there are more than three times as many trucks as in Oklahoma, and more than seven times as many motorcycles. In Oklahoma there are only two manufacturers of automobile supplies and accessories; in New Jersey there are one hundred twenty-four.

Such information will give you facts about your territory. Facts in themselves do not prove anything. It is only your own reasoning based upon facts that will give the solution of your problem.

In conjunction with a determination of the extent of your original territory you will want to make a study of the demand for your product. It may seem unreasonable, but if you investigate the demand for your product thoroughly enough, you can actually tell what volume of your goods you can sell in a given territory before you start selling. And hundreds of concerns throughout the country are doing that very thing. They not only learn whether there is a sale for their product, but just how extensive the demand will be.

Predetermining Extent of Demand

Quite naturally there are some fundamental principles to be guided by in making a study of demand. No matter what product you may be selling and no matter how you may be marketing it, the same conditions govern the demand for your goods.

Is there really any demand at all for your product?

If your product does not possess any true value, if it is not something that someone can use to advantage and profit, all the money in the world cannot create a demand for your goods. The only thing to do is to switch your energies over into the development of some other product that people will want to buy.

Is the demand limited?

Your product may possess unquestionable value, and there may be a very real demand for it; yet if you investigate the market carefully you may find that the demand is not heavy enough to support a business. If that is the case, you must let this product be one of several—make it a side line to some other goods on which the volume of production can justify the operation and maintenance of a factory.

Is the demand natural?

A great many times I have said to myself after a salesman has left, "Well, he took my order, but he didn't sell me." Such salesmen offer goods for which they must create a demand in each individual instance. The demand is only artificial. If that is the case with your product, you will not only have to meet the problem of selling the trade to the value of your idea but of keeping them sold. That is a long process of education and requires constant prodding and stimulation. If the demand is natural you can look forward to the time when "repeats" will form a large percentage of your sales.

Is the demand seasonal?

The demand for skates is seasonal; so is the demand for straw hats or fur coats. At the same time you are considering this feature of demand, however, investigate the possibility of your changing that condition. You cannot change facts, but you can change tendencies and inclinations.

Stabilizing the Demands

One local manufacturer of ice cream put across a unique campaign of advertising to increase the volume of business during the winter months. While he of course was not able to create the same demand in January as in August, he did do a great deal to overcome the impression that ice cream was entirely a seasonal commodity.

Shoes are not worn out so fast when there is snow on the ground as when the cement sidewalks are uncovered. Jobbers of leather and shoe findings used to use this as a weak alibi for relaxing their efforts during winter months on the sale of repair-shop equipment.

But manufacturers of such products have changed that condition. In winter they call attention to the oncoming spring rush when the snow will be gone and when people put away their rubbers and overshoes. In summer they advise repairmen to prepare for early fall when the little folks, who have been going barefoot all summer, will be returning to school. And in other ways they have been able to stabilize the demand for their goods so that it is distributed evenly throughout the year.

Do not be misled by local conditions. People in Illinois do not buy many automobile tires during the cold months; but out in California motorists do not have to worry about putting their cars into "dead storage" for the winter.

Is the demand permanent or temporary?

If you are marketing some novelty or thing-a-ma-jig that will only appeal to passing fancy, it will be poor

business judgment for you to invest much money in buildings and equipment for its manufacture. If you do, you may some day find yourself with your plant and equipment but without any business—the demand for your fad will die out as quickly as it was created.

Is your product a necessity or a luxury?

It is said that food, clothing and shelter are man's only three necessities. But "necessity" and "luxury" are two mighty difficult words to define, as we learned during the war when the Government attempted to classify non-essential industries and non-replaceable employees.

A necessity is something you have got to have, no matter what it costs you. A luxury is something you would like to have if you could afford it, but something you can get along without it if you choose.

Our classification of luxuries and necessities is ever changing. The telephone, the dictating machine, the typewriter and the adding machine are articles which every office considers as necessities. A great many household articles are now looked upon as necessities which only a few years ago were not even dreamed of.

That your article may fairly be classed as a necessity does not mean, however, that you have a monopoly on supplying the demand for it. The mere fact that there is a natural and insistent demand will mean that you are entering a crowded field in which you can expect to find the keenest kind of competition.

The chances are certain that a great many other men have tried to meet that demand long before you attempted it. Some of them are now heads of large and influential organizations. Their particular makes of products are well known to the trade, they have established incalculable good will. You will enter this sort of field unknown. It will call for the best that is in you.

All of your brain power, your energy, your ability must stand ready to aid you in your struggle for recognition. By your integrity and fair dealing, by your persistent advertising, by your policies and by new angles from which you present old propositions you can enter into the field of competition without fear of failing to find the demand, meet it, and increase it to proportions which your most worthy competitors had not dared to think possible.

When you have convinced yourself that there is a definite, permanent demand for your goods, you must investigate the various ways of getting your goods to their consumers—or, in other words, the different methods of marketing your product.

Getting the Goods to Market

In general, there are only two main classifications into which all marketing policies are grouped. Either you will sell direct to your consumer, or you will sell through some intermediate distributor.

Bear in mind that I say "*Through* some intermediate distributor" instead of *to* him. Whatever the details of your marketing method may be, the person you have got to sell *to* is the ultimate user of your goods. If you prefer to reach him through dealers or jobbers, you cannot adopt the short-sighted belief that your interest in the sale ends the moment your goods are sent to your dealer and your invoice put into the mail.

It is true that a shipper's responsibility over goods ceases the moment those goods are delivered to the carrier, because it is provided by law that your express company or your railway company must exercise the highest degree of care in passing your goods along to the next party.

But jobbers are not by law required to do a single thing with your goods, and so your responsibility is quite different. This does not mean that you cannot pin any faith to distributors, that you should look upon them merely as a possible convenience; but I do wish to emphasize the fact that you must sell your goods to the consumer, and whether or not to employ the assistance of any group of organizations besides your own is the vital question to be investigated in determining the plans and policies upon which you will establish your claim for business.

It is obvious that any suggestions which I may make on this problem must necessarily be of a somewhat general nature, for your product may be so vastly different from mine, and some other reader may have a product entirely different from either of ours, that one could hardly be expected to lay down any hard and fast ironclad rules from which you should not dare to deviate.

So we can best approach the problem of a marketing policy and expect to provide some applicable information by explaining the advantages and disadvantages of these two main marketing plans—direct and indirect selling—and trust that such an exposition may enable you to investigate your problem broadmindedly with a conception of the good and bad points about the possible methods from which you must make a selection for your own business.

Establishing a Selling Policy

I presume, of course, that you appreciate the absolute necessity of forming a definite policy and sticking to it religiously. You cannot sell to "anyone" and expect to develop any repeat business or establish any real good-will. If you decide to sell direct, do so; and don't mix in with the jobbers and spoil the field for some fellow who is loyally using them as his distributive means.

If you conclude you will be best insuring success and progress by selling through jobbers, adopt that method, work with your jobbers heart and soul, and don't figure you are losing profit by turning over to some jobber the usual discount on an order which may happen to come in direct from a customer in his territory.

A selling policy has got to have a backbone to it, or it will never stand on its own feet and hold its head high. A selling policy is in that respect somewhat similar to a guarantee. The value of a guarantee does not depend so much on what it says as on who says it and how carefully it is carried out. The public is not particularly interested in the mere phrasing of the short expression, "Fairbanks O.K.," but it does bank on the word of the Fairbanks-Morse organization.

Don't be content with a half-hearted policy, for that will only prove to be temporarily successful, if it is lucky enough to be successful at all.

It will be a bit difficult for me to present an impartial discussion about direct selling, for I have a personal prejudice against that method, and believe its disadvantages outweigh its merits.

If you plan to work direct with your customers, there are three general ways in which your sales promotion work can be accomplished, and those are by mail, by salesmen, or by branch offices.

The first method requires the smallest outlay of money. I do not mean that it is the least expensive per sale, but it can be conducted on a small scale with

modest expenditures which the other methods, by their very nature, do not permit.

Your direct-by-mail sales efforts would consist of one or all of form letters, printed matter such as circulars and catalogs, and trade paper advertising. The value of any of these forms lies in their continuity. You cannot expect to run an ad in some trade paper for only a single issue and attract the attention of every interested party. There are a great many who will not notice your first advertisement just as there are some who will not read your first letter or look through your first circular; but if you keep pounding away and driving at them, sooner or later you will convince them that you are submitting something that is at least worth an investigation.

Salesmen have a great advantage by being actually on the job. They come in personal contact with your customers and can learn the attitude of the trade toward your goods. In actual results, too, they will do better than the same money spent in printed matter or space, for I shall never be convinced that actual personal interviews can be beaten for getting business.

If you cannot afford at first to keep a salesman on the road, it is quite probable you can arrange for your goods to be presented as a sideline on a straight commission basis. If your products have real merit, and have possibilities of big development, you may be able to find a good, gilt-edge man covering a wide territory who will handle your line of goods along with his own. In that way you need not worry about salary or traveling expenses; for he will be paid only in proportion to actual sales, and you will usually find that the percentage which you must pay in commissions will not run so large as your percentage of sales expense if you figured the total cost of one of your direct mail campaigns in proportion to the dollars of orders received in return.

Having your own branch offices in different cities or sections is of course the most satisfactory direct selling arrangement, although it is also the most pretentious.

However, the men in your branch offices will be unlike jobbing distributors in that you will be their employer, and they will have a very direct obligation to you as employees. If results are not forthcoming you can make a change in personnel and eliminate those who are not justifying their position as your representatives.

Ordinarily, the farther you are removed from the ultimate users of your goods the more pleasant will be the management and conduct of your business. If you deal direct with your consumers, there will be a great deal of C.O.D. business, and a multitude of small accounts that hardly justify the bookkeeping expense involved.

It is possible the class of people with whom you must deal will be individuals not financially responsible, or small business men whose ratings may not be any too good; and so you cannot expect to be without credit and collection problems.

If you sell through jobbers they will undoubtedly be established, well listed concerns who discount their bills; so that under normal conditions you can expect your money will come in when due.

Some concerns, yes, a great many, who sell direct feature the idea to their trade, "cut out the middleman's profit." They appeal to their customers on the basis of lower prices because they do not have to pay any discounts to jobbers.

That, I believe, is a fallacy. You will have a selling expense no matter what the details of your sales policy may be. If you sell direct there will be extensive advertising expenditures or traveling expenses which you would not have if you worked through jobbers. And yet, with that method there would be the jobbing discounts. And in a large majority of businesses I think it is six of one and half a dozen of the other.

You will hardly be able to "cut out" any expense or increase your profit by going direct to the user and getting full list price for your article instead of accepting a somewhat smaller payment and letting the difference remain with your distributor to compensate him for his efforts.

Competition with Established Firms

Remember also that you are organizing a new company. If you happen to be located in Chicago and someone in Baltimore receives your letters or sees your ads, your name will carry no prestige whatever, for you will be an entire stranger to them. On the other hand, a salesman for some large Baltimore wholesale house might go to that same prospect and his words would carry a great deal of weight. If his house were an old-established firm with a reputation for selling only quality products he could say to your prospect, "By George, here's something made out in Chicago that's absolutely the best yet. Just a new concern, but they've got something; you mark my word, they won't be little very long," and your prospect would be likely to be favorably impressed and convinced.

Prestige and good will are the most valuable assets which appear in the financial statements of some of our largest corporations; and in your first statement they cannot be listed at any value whatever. If you can have your goods presented by concerns with both those assets, they are just as valuable to you as though they were in your own books.

Of course, you will not find that jobbers will receive you with open arms. You cannot help but expect that they will be somewhat skeptical, and reluctant to add to their many lines one which is not well known to the trade. And that is why I stated that the person you must sell *to* is the actual consumer.

Use enough direct advertising (directing inquiry of local jobbers) so that customers will come to the jobbers in their territory and say, "I've been getting some literature on so-and-so, do you handle their goods?" And if you can get enough people to do that, you can readily obtain the co-operation of the jobber in selling your goods for he will have been convinced right at the outset that there is a demand for them.

How to Advertise

Then let your advertising take the general form of "dealers helps"; that is, advertising which will help your jobber sell more of your goods. May be it will be printed matter which he can distribute in his mail. If it is mailed direct by you, or if it is magazine or newspaper advertising under your name, you need only to direct the inquiry or order through the local distributor in order to convince him that you are really working with him earnestly.

It is interesting that in a recent issue of *System* there were exactly 100 advertisements of manufactured products. Of these 100 ads 12 said nothing about how or where to obtain the goods advertised. In 20 ads some remark was made to direct the sale through a local distributor, such as "Your stationer can supply

you," or "Dealers in all cities." Four ads stated "Dealers wanted"; these by probable new companies anxious to establish agencies. "Branch sales offices in principal cities" appeared in 16 ads, and among these were the Addressograph, Dictaphone, Multigraph and similar well-known office equipment. This leaves 48 ads, and in this number there was some coupon or statement which said in substance, "Write to us."

From Manufacturer to Consumer

This seems to indicate that more than half the concerns manufacturing office equipment sell direct to the consumer. However, I believe that in a number of those cases (as I have found by actual investigation) it is only the appeal that is direct. I have written to several of those concerns and many times the reply says, "We have referred your inquiry to The Blank Co., our representatives in your city, and have asked that one of their salesmen call on you to explain the merits of our products."

And, of course, when they write to their jobber they emphasize the fact that my writing direct to them for info mation indicates that the jobber is not combing the territory as thoroughly as possible to reach all customers.

You must not overlook the fact that there are some classes of people who almost insist on doing business with the manufacturer. They believe they can get better treatment, better service and a better price by going direct to the factory. Then, too, a farmer, for example, prefers to transact business with some individual he knows rather than with a corporation in some far-distant city.

How to market your product is just as important as how to build it. You should proceed very cautiously in establishing a sales policy; but once that policy is established, let it be your policy in *every single sale*, and your buyers will not fail to develop a confidence in your dependability, which will find expression in the volume of your sales and the growth of your business.

A Lapping Paste for Motor Bearings

By I. B. Rich

The costumer's satisfaction on a motor overhaul job depends largely on the way both the main and connecting rod bearings are fitted. And in order to give the best results the repair man should know the different motors and the methods of lubrication. Force feed and splash oiling feed require different treatment.

Where splash oiling is used, the bearings are fitted as tightly as they can be run and when they wear a very few thousandths of an inch there is usually a pound or knock. With the force feed a definite allowance is made for oil between the crankshaft and the bearings, usually from 0.001 to 0.0015 in. This allows a space for the oil which, being forced in under pressure, actually keeps the metal surfaces apart and greatly prolongs the life of the motor.

For the splash oiling motor there is probably no better method than that of "burning-in" which was developed at the Ford plant and is used in Ford service stations. With this method the shaft is run until the bearing metal softens and starts to flow, which is only a matter of seconds, usually less than a minute. This, if carefully done, gives a good bearing which is better in every way than a scraped surface. It is probable that this method could also be used for a force feed bearing by putting in the proper shims after "burning-in."

Care must be taken to allow sufficient end play and yet not so much that the oil pressure cannot be maintained in the bearing. In other words, if the oil can flow too freely without being restricted by the thrust collars or fillets, the pressure may be reduced below that necessary to keep the metal apart. If on the other hand, the oil cannot flow out the ends, it soon burns up and there is little or no lubrication.

How the Bearing Was Lapped

One of my friends who is an expert on racing motors, fits his bearings in a very simple and interesting manner. He carefully calipers the crankshaft for each bearing and reams the bearing as near that size as possible. Then he takes out a very thin shim, puts a special lapping paste on the bearing, screws down the cap and makes a few turns of the shaft or connecting rod. He then wipes out the bearing, examines its surfaces, and if satisfactory, puts the shaft back with a pair of shims under the cap to give the proper thickness of oil film. If it isn't quite right, he repeats the lapping until it is.

His whole secret of success is in the kind of paste he uses. He doesn't use emery, carborundum, alundum or any of the ordinary abrasives. He keeps a cake of Sapolio handy, shaves a little of it off into a small dish, mixes it with either water or kerosine so as to make a paste and finds it the best lapping mixture available. He insists that it does not embed itself in the bearing metal, that it loses its abrasive qualities in a few seconds and has no bad after-effects. It does not cut the shaft, only the white metal bearing. As proof he points to many racing motors he has fitted up in this way and run them at top speed almost as soon as they were put in the cars.

I've seen cylinders lapped with Sapolio years ago, before the days of grinding, with good results. There may be other uses for Sapolio lapping paste that will save both time and money.

Metal Cutting Tools—XIV

By A. L. De Leeuw

(Continued from last week's issue)

IF THERE were no other elements to be considered except the lubricating qualities of the liquids used and the nature of the chip, the whole matter would be fairly simple. But there is another item which has already been mentioned and which plays a great part in the function of a lubricant, and that is its capacity for cooling.

Coolants

The object of the use of a coolant is to prevent the tool from getting so hot that its temper will be drawn. There are various ways in which a tool may break down. The pressure may be too great for the cross-section and overhang of the tool and cause failure by breakage; or the material to be machined may be gritty and act on the cutting edge as a grinding wheel would, except that instead of grinding the tool in the way we desire it to be ground, it would in all probability grind it in such a way as to destroy its usefulness. This manner of failure is quite common with grey iron or steel castings containing sand pockets. Again, it may break down by wear, caused by the chip rubbing over the tool surface under high pressure. At first such wearing of the tool may make it actually more efficient, as was pointed out when speaking about lathe tools in general; but finally the section of the tool which has to support the pressure of the chip becomes too small and failure results either from the breaking out of a part of that section, or else because the cross-section is no longer sufficient to carry off the heat. Finally failure may result from the inability of the tool to dissipate the heat generated by the action of cutting.

Ordinary tool steels lose their hardness when heated to about 600 deg. We say about 600, because there is quite some variation possible with different grades of carbon tool steel. Good high-speed steels lose their hardness at about 1,200 deg., and there is more variation in the temperature at which the hardness disappears with high-speed steel than with carbon tool steel. It would seem at first glance that the high-speed steel would be able to do about twice as much work as the carbon steel. But as a matter of fact, it will do even better than that. A little thought will show clearly that this must be so. Suppose we had a piece of material which would lose its usefulness at 100 deg. and another piece of material which would fail at 200 deg. and suppose further that the temperature of the room in which we make our experiments is 70 deg. Then the additional temperature which may be taken up by the first piece of material before failure is 30 deg. and for the second piece 130 deg., as the increase in temperature is practically proportional to the amount of heat taken up, we may say that the second piece can take up an amount of heat more than four times as much as the first piece before failure.

But even this does not entirely express the greater ability of the second piece to stand heating without failure. This proportion would be correct if we place the two pieces of material to be tested in an oven; or in other words if we place them in a position where the surroundings are heated up to the same temperature as that to which we wish to test the pieces. However, this is not the way in which a tool takes up heat. It is surrounded almost entirely by air at the temperature of the room, 70 deg. When the cutting action, that is, the separation of the chip, the breaking up of the chip, and its flowing over the tool surface, causes heating, this heating only takes place at a small portion of the tool, whereas the rest of it, being surrounded by air at 70 deg. will try to carry off this heat. If we should heat the piece to 90 deg. and then stop heating it further, it would be some time before the temperature had dropped to 80 deg. This drop in temperature does not take place evenly. It is more rapid when the piece is at a temperature of 90 deg. than when it is at a temperature of 81 deg. because the rapidity of the change in temperature depends on the difference in temperature between the piece and the surrounding medium.

Similarly, when a piece of high-speed steel is heated up to 1,100 deg. (that is, somewhere near the point where it would break down), it will dissipate heat very much more rapidly than when a piece of carbon steel is heated to about 550 deg. This, again, makes the high-speed steel more effective than the carbon steel. There may be a point during the use of a tool when it dissipates heat as rapidly as it receives it. When this equilibrium is established below the point where the tool would soften, there is no danger that the tool will burn out. If on the other hand it receives heat more rapidly than it can dissipate it, the temperature will keep on rising until finally a point is reached where the tool loses its hardness. We can well imagine a case where the excess of heat generated is quite small, but even under those conditions a point must finally be reached where the tool will be overheated. In such a case it would be easy to prevent the tool from burning out by a small amount of coolant. As a rule, however, the point of equilibrium is not so fixed that we can say with absolute certainty that there will be no trouble if we take a cut at 60 ft. per minute, and that there will be trouble when we run it at 61. In other words, there is a wide danger zone.

Coolants are used to keep the temperature of the tool with a fair factor of safety below this danger zone. They are used to assist in dissipating the heat the machine receives. It must not be forgotten that the heat generated is normally carried off in various ways. The tool itself conducts some of the heat to the machine where it is readily dissipated on account of the large radiating surface; part of the heat is carried away with the chips, another part is carried off by the work, and still another part, and generally a very small one, is carried off by the surrounding air.

A further point to be remembered is that the heat is really generated in the chip and at the point where it is being separated from the work. The tool itself does not generate heat, because no change is taking place in the tool. The chip does not have its highest temperature at the point where it is split off from the work; because some time later, that is when it flows over the tool, it is still further deformed and broken up. Close observation will show this very readily. We see, then, that the heated chip bears heavily on the tool

and that the fact that the work carries off some of the heat does not assist us much. The highest temperature of the chip being right above the tool it becomes necessary either to interpose a coolant between the chip and the tool or else cool the chip at the point where it strikes the tool. Better yet, do both.

It would seem at a first glance as if interposing a film of lubricant between chip and tool cannot have much effect on the cooling because it must necessarily be extremely thin if it can exist at all. In the discussion of what a lubricant does when we take a cut, we saw that the lubricant flows into the small triangular opening between work chip and tool and we can readily imagine how it must be carried along by the chip and be spread out in a thin film between chip and tool, provided, of course, that the lubricant has the necessary body to stand the heavy pressure of the chip. Thin as such a film may be, it interposes a material between the chip and the tool which prevents the heat from being carried over by direct convection. This would not help much if the little film of lubrication were stationary as it itself would very soon be heated up. But as a matter of fact this film is constantly renewed and flows over the tool as rapidly as the chip; so that the effect is the same as if a chip coated on the under side with a film of oil were flowing over the tool. We see, then, that, a lubricant also has some effect as a coolant.

The greater part of the cooling effect, however, is obtained by pouring a mass of coolant over the heated chip. One sees often how the operator directs his stream of coolant on the work. This, of course, has some effect because it cools the work itself and therefore allows the heat from the chip to flow more rapidly into the work. Nevertheless, the point of highest temperature remains right over the tool point, and this is the point which should be struck by the stream of lubricant. A relatively small stream at that point will have more effect than a heavy stream on the work. This does not mean, however, that a small stream of lubricant is to be recommended, for the practical difficulties of directing such a small stream would be such as to make it very uncertain whether the proper spot would be struck. It is therefore advisable to use a large stream of coolant and direct it as nearly as possible on that portion of the chip which bears heaviest on the tool.

If the liquid used had to meet no other requirements than its ability to cool the chip, water would be the best material to use. Not only does water conduct the heat more rapidly than oil, but it has a greater capacity for heat than practically any other material; that is to say, it takes more heat units to raise the temperature of a pound of water one degree than for practically any other material. As a result the liquid which, of course, is used over and over again, remains cool for a greater length of time and therefore retains its ability to carry off the heat.

There is still another point in its favor. Oil can be raised to a very high temperature and remain oil. If the temperature is raised too high the oil will decompose. It is possible, therefore, when using oil as a coolant to raise this coolant up to a temperature where it is no longer useful as such; and, when this happens, there is a great possibility that part of the oil has been decomposed, leaving a sediment in the remainder of the oil. This makes the oil unfit for further use or, at the best, it must be cleaned before it can be used again successfully.

Water, on the other hand, cannot be raised to a high temperature. When the temperature reaches 212 deg. F., water turns into steam which escapes, leaving the remainder of the water as it was before. At all times water retains its ability to carry off heat, provided the chip to be cooled is hotter than 212 deg. which, of course, is the case when it is at all necessary to use a coolant. When water has reached the temperature of 212 deg. it evaporates and this evaporation will carry off more heat. If, for instance, the temperature of the water is 62 deg. at the beginning of the operation and it is gradually raised to 212 deg., each pound of water will have taken up $212 - 62 = 150$ heat units.

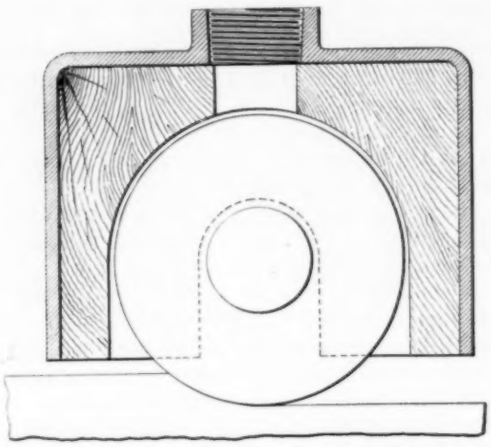


FIG. 229. CAST IRON AND WOOD BLOCK SHIELD FOR COOLANT STREAM

If this pound of water is now evaporated, 970 heat units are required to convert the water into steam; so that a pound of water is capable of absorbing $970 + 150 = 1120$ heat units without being raised above 212 deg. If we should use olive oil, a pound of this coolant could take up only 52.5 heat units before it is raised to 212 deg., because the specific heat of olive oil is 0.35; so that one pound of this material, in order to have its temperature raised 150 deg. would require $150 \times 0.35 = 52.5$ heat units. Under similar circumstances paraffin oil would absorb 78 heat units; ordinary machine oil 60 heat units. This shows clearly how very much superior water is as a coolant compared to various oils.

Water alone cannot be used in machining operations because of the corrosive effect it would have on the machine parts, and it is therefore customary to mix it with some ingredient which will prevent or minimize this corrosion. Soda and soap are commonly used for this purpose. Though most excellent as a coolant, water lacks lubricating qualities, so that where it is necessary to provide for both lubrication and cooling, pure water or soap or soda water does not meet the requirements. In late years various so-called soluble oils have been developed which permit of an oil being mixed with water. The proportion of water determines the extent to which the mixture is useful as a coolant and as a lubricant. Many of these soluble oils leave a residue which is liable to get into the machine bearings and to interfere with the proper action of the machine. In recent times, however, cutting compounds have been put on the market which have, to a high degree, the qualifications required of a lubricant and which can be mixed either with water or with some oil of high specific heat, such as paraffin oil. Such cutting com-

pounds have been used very successfully both as coolants and as lubricants.

The foregoing paragraphs explain to a certain extent the action of a liquid for the purpose of cooling or of lubricating. We can see how such a liquid permits us to raise the speed or increase the feed without overheating the tool, we can also understand why less power is required when using the proper lubricant, but no light has been shed on the manner in which a liquid affects the finish of the piece, nor why the size of a piece should change with a change of cutting compound. That this is so was very forcibly illustrated to the writer when he made some tests of various lubricants to be used on an automatic screw machine. A piece was made requiring a form tool, and the condition of the machine, tools, etc., was such that pieces could be made within the given tolerance of half a thousandth of an inch. This was the case when the regular lubricant was used. In testing out a new lubricant the following procedure was adopted.

Twenty-four pieces were made with the old lubricant and then tested for size. The machine was then cleaned out and without changing any of the adjustments, twenty-four more pieces were made with the new lubricant. All the pieces made with the new lubricant were of a larger size, and not only that, but the variation in size was such that they were from 2½ to 5 thousandths of an inch larger than standard. In order to be sure that the tool had not dulled, the machine was emptied out once more and refilled with the old lubricant and again without changing the adjustments, after which a third lot of twenty-four pieces was made, which were found to be correct again. It might be possible to explain this matter, but to the writer's knowledge, so few observations have been made in regard to this subject that it is not wise to attempt an explanation at the present time. This matter is of great importance to the machine shop and should be investigated very closely.

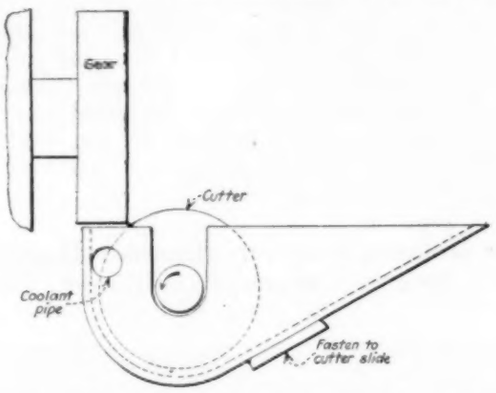


FIG. 230. COOLANT SHIELD FOR USE WHEN CUTTER IS BELOW WORK

A third use to which liquids are put is the ejection of chips. In deep drilling operations and in trephining operations this use of a liquid is of great importance. In the article on drilling, it was shown how forced lubrication can be used to eject chips when drilling deep holes. The exact manner in which the lubricant should be guided to the drill point and the exact manner of exit of the chips must be studied in each individual case, and depends largely on the shape of the tool which must be used for the operation.

The foregoing paragraphs considered the use of a single point tool, or, for that matter, a form tool. In all lathes, screw machines, planer and shaper operations, the tool point is embedded in the work—that is, covered by the chip—for a considerable length of time. When a long shaft has to be turned up the tool point is never relieved from work until either the job is completed or the tool requires renewal. However, there is another class of work in which this condition does not prevail, namely the milling operation; and we refer here to simple milling, gear cutting, hobbing, thread milling, etc. A tooth of a milling cutter passes through the work and then for the greater part of a revolution through the air. If a milling cutter takes a cut ¼ in. deep, and if it is 3½ in. in diameter, a tooth will be in the work during 31 deg. of its revolution or practically one-twelfth of the time. During the other eleven-twelfths of the time it runs through air or through the coolant and if we can manage to bring the temperature of that tooth down to its original temperature before it enters the work again there will never be any accumulation of heat. If, during its passage through the work, this tooth has not been heated beyond the danger point it will never be heated to that point. If the milling speed of the milling cut is 60 ft. per minute, that is, if the cutter makes 65 revolutions per minute, it will take a single tooth less than one-twelfth of a second to pass through the work. It cannot have been heated very much during this short time unless the cut taken is unusually heavy. It will be seen, therefore, that it should be possible to take heavy cuts and at extremely high speed if it is possible to cool a tooth down to its original temperature during the time when it is not embedded in the work. This consideration led the writer to the now well-known system of stream lubrication.

Stream Lubrication

The method of stream lubrication is a method by which the cutter is surrounded for a large portion of its circumference by a coolant which is constantly renewed. Where the cutter is below the work it is possible to have it running in a bath of the coolant, keeping the bath filled by an inlet pipe and removing the surplus by an overflow. Such a condition may exist in a gear cutter or hobbing machine or in some special milling machine. As a rule, however, cutters are on a level with or above the work to be milled. In such a case the liquid cannot be kept in contact with the greater part of the cutter unless some special provision is made for this purpose. The arrangement used is as follows:

A shield is placed over the cutter, straddling the arbor and coming as close to the work as may be safe. The inside of this shield follows the outline of the cutter, allowing only a small amount of space between cutter and shield. The coolant is admitted at the top of the shield through a large pipe. It should be emphasized that this pipe must be large; in other words, that the amount of lubricant supplied per minute must be quite considerable, in order to apply this method successfully. If the opening of the pipe is greater than the opening between cutter and shield, that is, if the inlet is of greater capacity than the outlet, then all of the space between cutter and shield will always be filled with coolant, and yet this coolant will be continually renewed. This system was applied for the first time on the Cincinnati semi-automatic milling machine which, as a matter of fact, was designed with

this system in view. Some of the results obtained were described in the *American Machinist*, issue of April 16, 1914. Relatively heavy milling cuts were taken at a speed of 835 ft. per minute, or about ten times the speed which would ordinarily have been used for such a cut.

Every size and shape of cutter requires its own shield so as to keep the space between cutter and shield down to a minimum. In order to avoid the necessity of making an almost unlimited variety of shields, they are made of a cast-iron shell with an inserted block of wood and the space for the cutter is made by milling out a cavity in the wood by means of the cutter itself. The shield is filled with a solid block of wood, clamped to the table of the milling machine, after which the knee is raised. When the cutter has dug itself into the wood to a sufficient depth, the table is fed by hand a short distance to the right and to the left and also forward and backward, giving a small amount of clearance all around the cutter. In this manner a few sizes of cast-iron shields will meet all requirements (See Fig. 229).

One of the most important things to keep in mind when applying stream lubrication is the necessity of using the liquid under low pressure. The higher the pressure the greater the amount of liquid required per minute to keep the space between cutter and shield filled, and the greater the disagreeable effects of splashing. It is advisable, therefore, to use some kind of pump with constant pressure, such as a centrifugal pump. In a gear pump the ultimate pressure which may be reached depends entirely upon the fit between the parts. The better the fit the greater the pressure which may be reached. Gear pumps are in use now which will furnish pressure up to 700 or 800 lb. per square inch. If a gear pump were used for stream lubrication and the pipe were partly choked off, the pressure would naturally rise. The ideal condition would be to use a pump with a head only a few inches above the outlet opening into the shield, and to use a pipe large enough to permit the passage of all of the liquid the pump will furnish.

Generally speaking the use of low pressure is to be recommended for almost all machining operations. Deep hole drilling, some cases of trephining—in other words, cases where the chips must be expelled by the pressure of the lubricant—are the exceptions. It might be thought that where a liquid is used for the purpose of lubrication only, high pressure might be of some advantage because this pressure would assist the liquid in penetrating into the small triangular opening between chip, tool and work; but the heaviest pressure we could use in practical operations would be very small indeed as compared to the force which compels the oil to enter by the adhesion between oil and metal, and against this small advantage we would have the very great disadvantage of most of the oil being deflected by the surface of the metal without being of any use. When a large stream of coolant is thrown on a tool and especially on a revolving tool, such as a milling cutter, only a few drops come in actual contact with the tool because the stream is broken up, due to the very pressure which we employ; whereas if we use a very low pressure we will have a solid stream and every particle of the liquid will have some share in carrying off heat.

When a coolant is used without a shield it is customary to direct the stream of liquid on that part of the cutter which is about to enter the work. This is wrong. It should be thrown on the cutter at the point where it leaves the work, in other words, on the hottest part of the tool.

Besides the advantage of increasing the possible speed of the cutter, a shield acts as a safety guard and for this reason alone should be used wherever possible.

In cases where the milling cutter is below the work, a shield can be applied underneath the cutter and this shield will naturally be filled with coolant. On the other hand, the chips will also drop into this shield, and very shortly fill it up unless some provision is made to carry them away. If the cutter runs at a very high speed it will throw the chips a considerable distance. All that is necessary, then, to keep the shield relatively free from chips is to make one side of the shield with a long taper. See Fig. 230. As soon as the shield is filled with chips far enough to allow the cutter to touch them, they will be thrown out, provided that the rear side of the shield is not too steep. This action takes place only if the cutter has sufficient speed, so that with a shield below the cutter, stream lubrication is not a complete success unless we use very high speeds, whereas with the shield above the cutter any speed can be used successfully.

Where very large amounts of liquids are used for coolants or lubricants, the liquid is also used for washing out jigs and fixtures and for cleaning the table of chips. For this purpose again a low head (low pressure) is required. High pressure of the liquid will drive fine particles of chips into corners and keep them there. Low pressure will float them off.

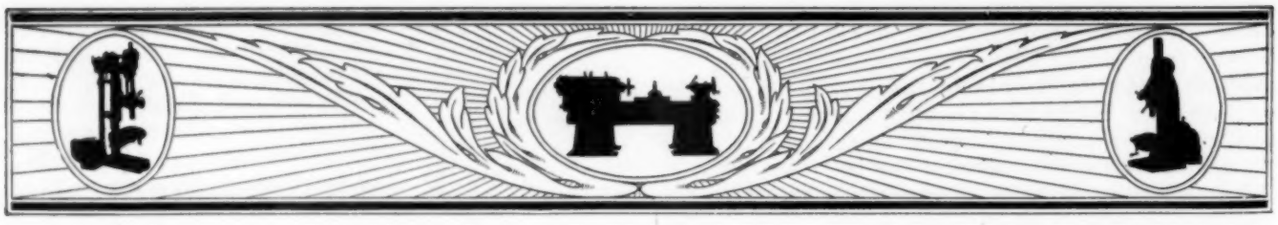
Are Hollows Worn in Hammer Handles by the Fingers of the User?

By John D. Riggs

In vol. 54, page 980, of the *American Machinist*, L. L. Thwing asks the above question.

Some time ago Morris Devlin used a carpenter's hammer in nailing together "spools" on which barbed wire is wound. This man succeeded in wearing grooves about ¼ in. deep in the handle of one hammer and had begun on a second hammer when I last saw him. He was keeping the hammer with the worn handle as a souvenir.

Morris Devlin made spools for a wire factory at Lawrence, Kansas, from about 1884 to 1898. I saw him last in 1895.



The Oilgear—A Variable Speed and Feed Control System

Machine Operator Maintains Complete Control Over Speeds, Feeds and Quick Returns—An Infinite Number of Variations Easily Made Without Stopping Machine

SPECIAL CORRESPONDENCE

THE search for a speed control system suited to the variety of uses for which variable speed power transmission is needed in the industrial field has led to the development of many interesting experiments.

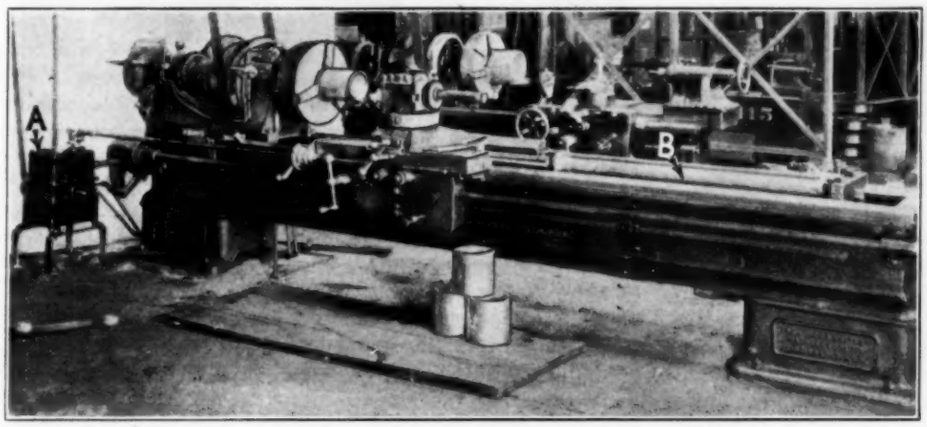
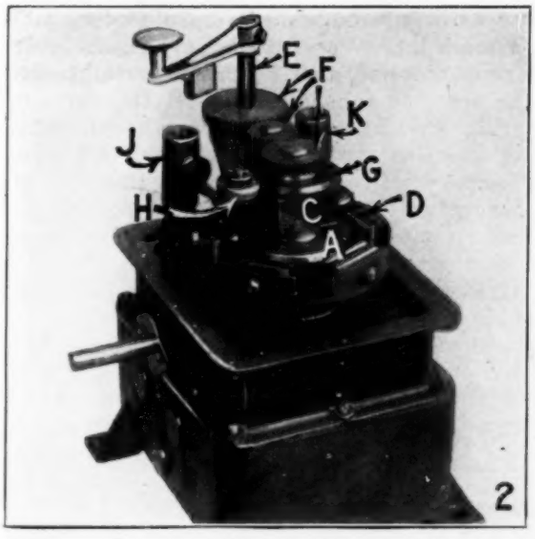


FIG. 1. LATHE EQUIPPED WITH "OILGEAR" FEED

Aside from the development of the variable speed electric motor, probably the greatest amount of inventive effort has been directed toward the application of hydraulics to this problem, a late development being known as the "Oilgear" system, recently brought out by the Oilgear Company, Milwaukee, Wis.

All devices of this class consist essentially of a pump which can be adjusted through a large range of delivery capacity, and a motor driven by the working fluid received from and returned to the pump. The working parts of the Oilgear system were developed with special reference to improving the feeding and driving of machine tools, although its application need not be confined to this field. The units herein described may be found available for a wide range of purposes, such as driving variable speed machinery in textile and paper mills, chemical industries, and for automatic control of stokers, etc. In combination with simple mechanical construction, this system employs some principles of automatic hydraulic control that are unusual in their features.

In the usual hydraulic plant a pump is used to generate the maximum amount of pressure which may be required, and the speed of the motor (usually a direct acting hydraulic ram) is not fixed by any relation of the working parts, but is adjusted by wire drawing the working fluid through a throttle valve, wasting a large part of the power originally generated. The speed of the motor is fixed by the operator when he sets the stroke of the pump, and the pressure of the working fluid driving the motor rises and falls directly with the resistance which the motor encounters—the pressure never being greater than actually necessary to do the work. The power input to the pump is directly proportional to the demands of the motor, and the speed of the motor is definitely fixed by the position at which the operator adjusts the control lever, which sets the stroke of the pump. If a satisfactorily simple embodiment of these principles can be attained, very wide fields for possible development will be opened. The *American Machinist* has already called attention to this matter in an editorial appearing in the issue of June 17, 1915, and on various other occasions.



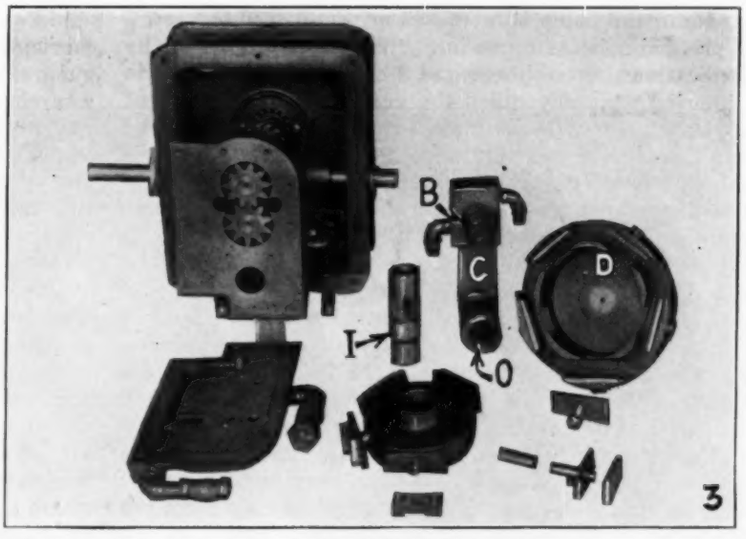


FIG. 2. CONTROL BOX WITH COVER REMOVED. FIG. 3. THE WORKING PARTS

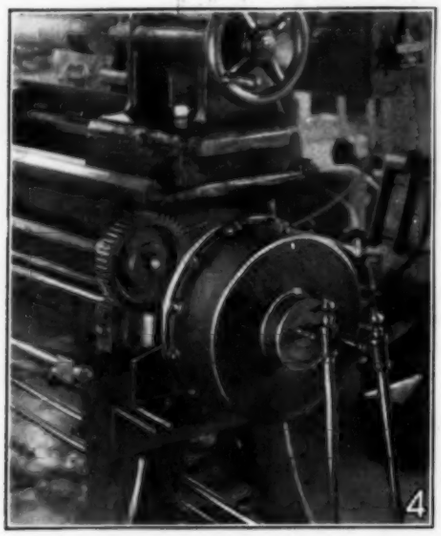


FIG. 4. THE ROTARY MOTOR FOR FEED SCREWS.

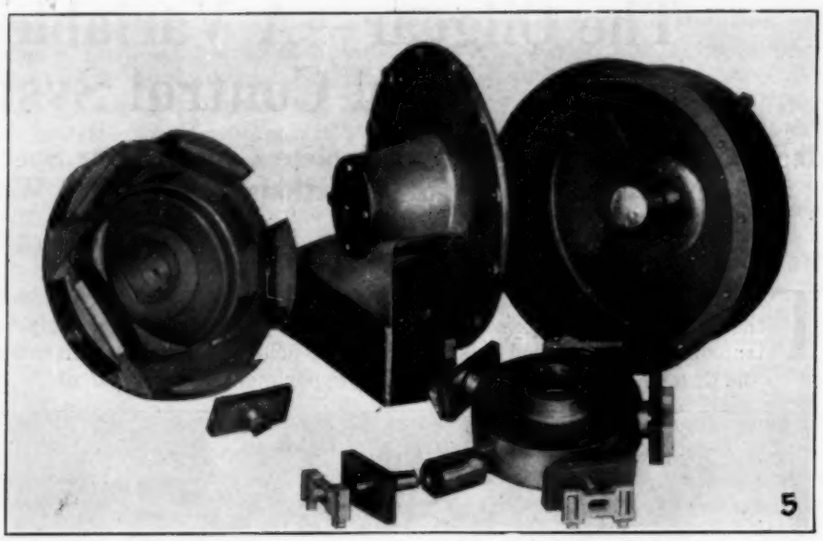


FIG. 5. THE PARTS OF THE ROTARY MOTOR

Every hydraulic transmission system consists essentially of a pump which receives the power and transmits it to the working fluid, and a motor driven by the working fluid and transmitting the power to the machinery to be driven. The pump is the most highly organized unit and may be considered as the heart of the system, as the motor may frequently consist merely of a simple direct-acting hydraulic piston or plunger. The pump unit of the Oilgear system comprises a revolving driver carrying five or seven crossheads and plungers, with a corresponding cylinder barrel revolving with the driver, and carrying the cylinders in which the plungers reciprocate. By shifting the center of the cylinder barrel the stroke may be varied to suit the conditions to be met. This stroke variation may either be made directly by the operator's hand, or may be controlled by an outside influence, such as pressure, temperature, centrifugal force, etc.

The motor unit may either be a simple plunger as mentioned above, or a revolving multiple plunger unit similar to the pump, except that in the motor the plungers generally have a constant stroke, so that stroke changing mechanism is absent. Consequently, the speed of the motor is dependent upon the rapidity with which the working fluid is delivered by the pump, and as the stroke of the pump is increased or diminished the speed of the motor is correspondingly influenced. In all of the applications herein illustrated a third unit or element is employed generally called the gear pump, and mounted in connection with the main pumping unit. This gear pump acts as a make-up pump for the system, drawing working fluid (generally oil) from the surplus supply in the pump, and keeping several pounds pressure constantly on the intake line of the main pump. In the typical hydraulic power transmission the capacity of the gear pump is small, as it only needs to return the leakage, and in some cases also to furnish a small amount of power for operating the stroke changing mechanism. In other applications (especially the feed control system illustrated herein, and in many forms of hydraulic press, etc., where plungers are used) the gear pump is enlarged to have a capacity which may be many times that of the variable pump. In such cases the gear pump acts not only to return leakage, but also to rapidly traverse the motor rams or plungers at low pressure. In connection with application to machine tool feeds, the gear pump affords a means of rapidly traversing the tool carriage at a speed many times the speed required for feeding.

The feed control system shown is especially designed to apply to the feeding and rapid traversing movements of machine tool carriages and rams. The principal unit is the feed controller, shown at *A*, Fig. 1, as applied to a production lathe, and shown in greater detail in Figs.

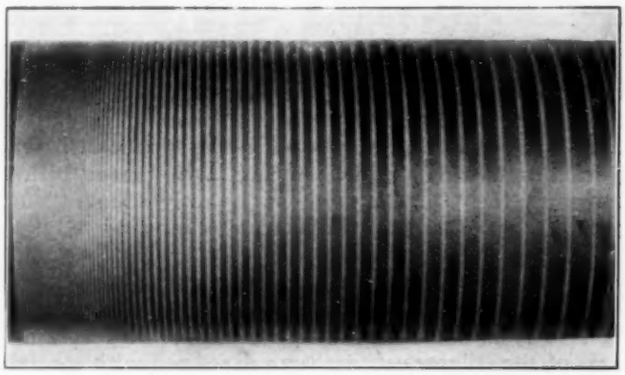


FIG. 6. AN EXAMPLE OF FEED VARIATIONS

2 and 3. The controller is essentially a casing including a small variable delivery pump having a capacity suitable for the small volumes called for in feeding tool carriages, a much larger constant delivery pump (gear pump) for rapid traverse, a stroke changing mechanism whereby the operator can accurately set the variable pump stroke and thereby control the rate of feed, and a control valve associated with the stroke changing handle, and operating to selectively connect one or the other of the two pumps to the feeding motor, according to whether feeding movements or rapid traverse movements are required at the moment.

The controlling casing is made up of three sections. The bottom section is merely an oil pot, provided to enable the controller to be applied to existing machine tools. The middle section carries all of the machinery, and can be incorporated without change into the original design of any machine tool, by merely casting a suitable oil pot into a headstock or housing. The top section is a cover only. The removal of the cover exposes the pump units as shown in Fig. 2. The plungers are fitted in radial reamed cylinders in the circular cylinder barrel *A*, closely fitted for rotation on a hardened and

ground ported pintle *B* (Fig. 3) and fitted into a swinging arm *C* by means of which the revolving cylinder barrel may be shifted from one side to the other of the revolving driver *D* carrying and operating the plungers. Both driver and cylinder barrel continuously revolve around centers which coincide when the swinging arm is placed in central position and whose distance from one another may be increased in either direction by swinging the arm either to right or left. As the cylinder barrel axis is moved to right or left the length of stroke of the plunger is correspondingly increased, and results in a flow of oil through the pump in direct ratio to the length of stroke. This mechanism also gives a reversal of the flow, oil passing through the pump in one direction when the swinging arm *C* is moved to the right, and in the opposite direction when it is moved to the left. The shifting of the swinging arm to increase or diminsh the length of stroke is controlled through the shaft *E* and gears *F* operating the cam *G* (Fig. 2). As this cam is rotated it acts against the fixed roller *H* to change the position of swinging arm *C* and hence shifts the center of the cylinder block as described. The cam *G* has other functions in connection with the operation of the control valve *I*, co-ordinating the stroke changes of the variable delivery feeding pump with the functions of reversal of rapid traverse, make-up of leakage, etc., all of which are controlled by valve *I*.

Cam *G* is made with extreme accuracy, giving a speed variation for the tool carriage capable of the finest degree of adjustment. Moreover, after the cam has been swung about through a certain angle it again returns the cylinder barrel to neutral position, thus cutting off the flow from the high pressure pump and preparing the way for further swing of the control valve which connects the flow from the gear pump to the feed motor, to effect the rapid traverse.

The feed cylinder or motor on a machine tool must have hydraulic fluid on both sides, and the entire system including pipe connections must always be full of fluid under a moderate pressure to exclude air and insure an absolutely steady movement of the tool carriage. The maintenance of this make-up pressure, return of leakage, etc., is an additional function of the gear pump.

Fig. 2 shows the assembly of the variable delivery pump. To right and left are relief valves, *J* and *K*, which permit the feed motor to be run against a stop or other obstruction without damage. The eccentricity between the revolving driver *D* and the cylinder barrel *A* causes the reciprocation of the plungers. The completely assembled controller with the cover removed is also shown in this view. The stroke changing cam, reacting against a stationary roller and operated by gears from the control handle which extends downward and ends in the control valve, is distinctly shown.

Each little plunger, *L* Fig. 3, is a hardened and ground sleeve or thimble with one end closed, and is fitted closely into a reamed bore in the cylinder barrel *A*. In order to prevent any possible binding due to mis-alignment, and also to avoid the necessity for extreme accuracy in indexing while machining, each plunger is driven by a loose fitting pin *M* screwed firmly into the crosshead *N*.

The hardened steel crossheads attached to the push pins, pressed steel roller cages containing rollers against which these crossheads deliver the plunger thrusts, and the outer roller thrust plates (duplicates of the crossheads) are all distinctly shown. The outside diameter of the revolving driver is about 8 in. The feed pump has a capacity sufficient to deliver a force of 5,000 lb. at any feeding speed up to about 24 in. per min., 10,000 lb. at any speed up to about 12 in. per min., 20,000 lb. at any speed up to about 6 in. per min., etc. By using different sized hydraulic feeding motors, the same feed controller may be used to feed a very large range of medium and heavy machine tools. Fig. 3 shows on the left a bottom view of the body casting with rapid traverse pump (gear pump) cover removed. The control valve seat *O* is shown empty, with the control at *I*. The group of detailed parts on the right comprise all of the working parts of the machine, and it is noticeable that they are all of simple cylindrical and plane form, readily manufactured by ordinary machining and grinding processes. The plungers, crossheads, rollers, and roller plates are all hardened and ground alloy steel.

Two types of feeding motors are employed; the direct acting pushing cylinder, and the rotary motor. The former is used when space conditions permit, as, for instance, on the lathe shown in Fig. 1, where the pushing cylinder *B* is mounted on the unoccupied part of the lathe bed with its piston rod attached directly to the lathe carriage. It is usually necessary in equipping old lathes to mount the pushing cylinder at the rear of the bed behind the headstock, the piston rod extending toward the tailstock and being bracketed to the rear part of the carriage.

The rotary type of motor is shown in Fig. 4, geared to the lead screw of a lathe. This form of installation is necessary for very long machines, and frequently for cress feeds where it is necessary to have a screw control of the tool slide. The rotary motor is of essentially the same construction as the variable

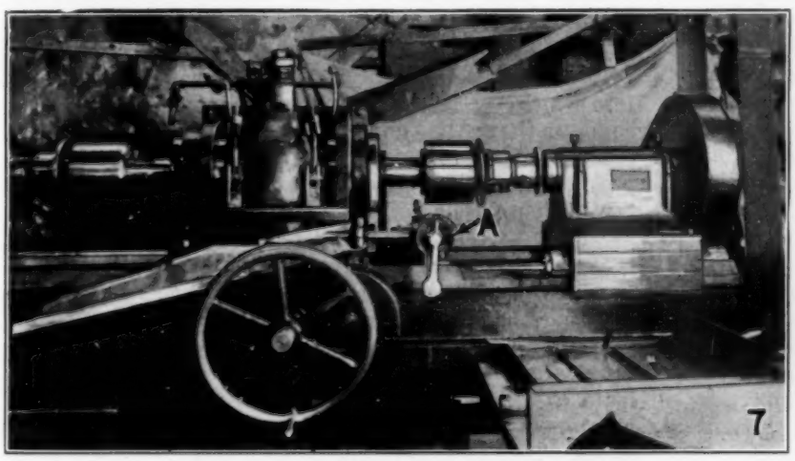


FIG. 7. APPLIED TO BORING AND TAPPING REAR AXLES.

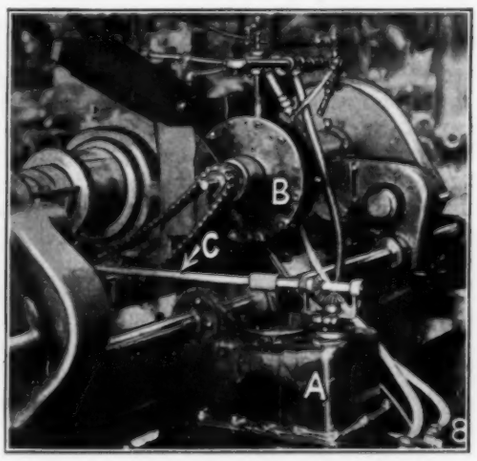


FIG. 8. ROTARY MOTOR AND CONTROL BOX

stroke pump, except that the swinging arm is omitted and the stroke remains constant. All of the working parts of the rotary motor are shown disassembled in Fig. 5. The gradual change from a very fine feed (0.003 in.) at one end to a very coarse feed (⅝ in.) at the other end, which this feed control gives without changing any gears or stopping the spindle, is graphically shown in Fig. 6. One of the advantages claimed for this type of feed gear for heavy machine tools is the rapid traverse movement, which is obtained without any additional mechanism, enabling the operator to move heavy carriages and rams promptly and without fatigue. The hydraulic feed enables the operator to readily increase the feeds when cuts become lighter, back out the tool for examination of cutting edge, and return it quickly into the cut without any disconnection of friction clutches, etc. Another prominent advantage on many production jobs is the ability to use two or three different feeds in quick succession on short cuts. In many cases the improvement to be effected justifies an installation on machine tools already in operation. Such a case is the double-headed boring and tapping lathe for automobile axle housings, Fig. 7, which shows the control handle of the Oilgear feed at *A* within easy reach of the operator. Fig. 8 shows the feed controller *A* and motor *B* installed at the rear of the lathe, with feed control rod *C* extending through to the front. Before this installation was made the operator had to turn the large hand wheel, Fig. 7, more than 70 turns, requiring more than one half minute of hard work in every eight-minute period to back out the tools and place a new casting in the jig. In addition, the facing cut had to be fed by hand as the cycle was too short to permit changing to a suitable facing feed.

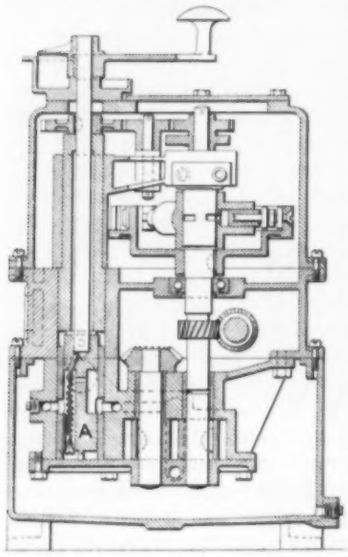


FIG. 9. VERTICAL SECTION THROUGH CONTROL BOX

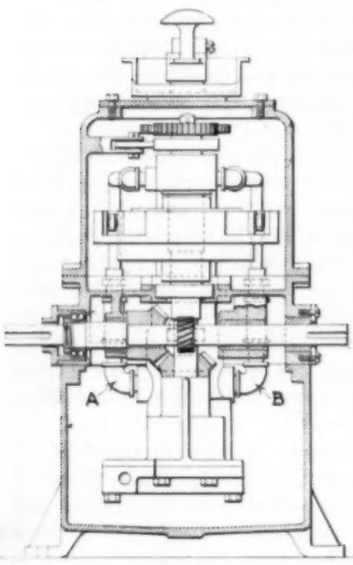


FIG. 10. ANOTHER VERTICAL SECTION

This rapid traverse is now affected in about 12 sec. by power. From ½ to ¾ of a min. of time is saved on every cycle besides the fatigue of the operator. It is also noticed that the operator is no longer reluctant to run the tools back for occasional examination.

Figs. 9 and 10 show two vertical sections of the assembled feed controller which will enable those interested in the detailed operation to trace the relations of the various parts previously shown. *A* and *B*, Fig. 10, indicate the two main pipes, which receive the discharge of both the variable delivery pump and the gear pump, under conditions determined by the position of the control valve *A*, Fig. 9. The leads from these main pipes extend out through the casing and are taken to the two pipe connections of the feed motor. As previously stated, this motor may be either a direct acting pushing cylinder or a rotary plunger motor. In any case, delivery of fluid from the feed controller, varied in quantity and direction, compels the feeding motor to perform exactly the function desired by the operator. The pressure in the system may be large or small according to the resistance offered to the cutting tool, but the feed motor moves at the exact rate of speed called for by the operator without regard to the pressure which it must exert to do the work. If this pressure rises above the maximum required for feeding, one or the other of the relief valves shown in Fig. 2 will open and permit the feed motor to come to a standstill without damage. This function is made use of in locating shoulders, etc., in work to be machined; as it is only necessary to set rigid stops and let the carriage run against them.

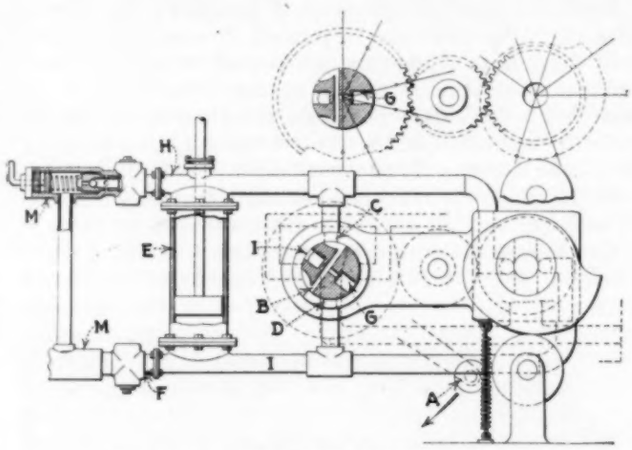


FIG. 11. A TOP VIEW SHOWING CAMS

Fig. 11 diagrammatically shows the control valve of the feed controller in one of its feeding positions, with the control handle *A* turned about 35 deg. from neutral. When in neutral position the by-pass *B* connects the two opposite ports *C* and *D*, thus permitting the tool carriage to be moved by hand. The typical feed motor is indicated by the pushing cylinder *E*. *M* indicates the relief valves which prevent excessive pressure.

In the position shown *F* is the high pressure main, into which the feed pump is delivering, while the gear pump discharge, is connected to a vertical duct *G* in the control valve which is in communication with the low pressure main *H* and acts to replace leakage and maintain an absolutely full system. It will be seen that if handle *A* be turned in the direction of the arrow until it is 90 degrees from neutral position, the delivery port *G* which receives the gear pump discharge will register with port *D* discharging into main *F*, while an opposite port *I* in the control valve will register with port *C* on the opposite side, and thereby communicate with main *H*. The pump now delivers a large volume of oil into one of the mains, causing rapid traverse of the feed motor *E*, which is reversible.

Incentive or Production Basis of Wage Payment

II. The Reward for Standard Accomplishment—Variations in Types of Incentive—The Aristocracy of Skilled Labor—Individual and Group Reward

By HENRY H. FARQUHAR

THE previous article in this series dealt with the part which the management must play in properly administering work in process and in establishing standards of production whereby a measure of the efficiency of operation might be secured. It was pointed out that such measures lie at the very foundation of modern management, and that with them properly functioning the question of adding an incentive method of pay was to a certain extent incidental or at least debatable. Granted that payment according to production is deemed desirable, however, and having reached an understanding on production standards for the various kinds of work, the next step is the determination of the type and amount of reward which shall be held out as an incentive for doing the work as specified. The first requirement in this respect follows:

(6) *The type of reward must be adapted to the standard determined upon.*

Most of us are probably familiar with the experiences of a group of American engineers who attempted to increase the production of Mexican laborers by installing a production bonus similar to one that they had used at home. Production increased satisfactorily—up until Thursday night when the peons had done the customary week's work and earned the usual week's pay. Their standard of living was very much more stable than is the case with most American workmen, and a desire for more money had little place in their scheme of things. A somewhat similar thing occurred at the outbreak of the war, when it was desired to double the South American harvest of crude rubber, and to stimulate the energies of the natives the price per pound previously offered was doubled. Thereupon the amount of rubber harvested immediately fell to one-half what it had been before. It was not more money in this case, but more *leisure* that they wanted. We, who are so accustomed to thinking in terms of money, are prone to overlook the fact that others may not see the matter as we do. The reward must take the form, be it in money or otherwise, that the workmen most appreciate.

Adapting Plan to Conditions

One more illustration will impress the importance of fitting the type and amount of the reward to the specific conditions to which they are to be applied. I recently encountered a case where an incentive method of pay on an individual job basis had been discarded, not because it is not a perfectly good system under conditions suitable to its use, but because in this case the attempt had been made to use it where thorough standardization had not and could not be secured, with the result that bonus was occasionally lost through neither the men's nor the management's fault.

Such cases as these must not be interpreted as arguments against incentive payment as such, or as an indictment of any particular plan of incentive payment. No plan is sufficiently comprehensive to meet all conditions, and every set of conditions must be analyzed with a view to selecting or devising a type of reward which will fill the bill. The variations in detail which may be incorporated under one or another set of circumstances are limited only by one's imagination and ingenuity in meeting his specific problem. Thus in some cases no financial incentive whatever is offered for accomplishing the standard amount of work, but a stimulus is furnished through detailed individual records and a public posting of individual performances. Another practice which has been found both simple and effective in certain cases illustrates the variety of choice one has in adapting the reward to local conditions. This consists in paying all employees a straight hourly rate according to the class of work and the employee's ability to perform it. Each job has set against it a minimum rate of pay, and also a higher standard rate, and each task has a carefully determined standard in amount and quality of production. If the worker accomplishes the standard over a specified period of time he is rated as a *Class A* man with the standard hourly rate of wages pertaining to this class of work; if he does not accomplish the tasks set, his pay reverts to the minimum rate. This plan has much to commend it, particularly when dealing with certain groups of employees.

Reward Must Be Proportionate

Somewhat akin to the foregoing is the consideration of the amount of the reward as related to character of service required:

(7) *The amount of reward must be proportionate to the skill and effort required for standard performance.*

The pride of the average workman in any degree of skill which he possesses over his fellows is much keener than many of us realize, and the gulf between the "skilled" and the "unskilled" is exceeded only by that between the possessor of a job and the jobless. I will not attempt to indicate just how these differences are to be recognized under different conditions, but will simply emphasize the fact that they must be recognized and provided for in fixing the reward for each class of work. It goes without saying that in all cases an extraordinary amount of work must be recognized through an extraordinary amount of reward.

Having determined the amount of reward which differentiates between various classes of work, the next step is to check the effects of the proposed payment on the cost of goods produced. The regulation therefore follows:

(8) *The amount of reward must bear a proper relation to the total cost of production.*

The payment of an additional amount of money for a specified high production should not ordinarily increase total cost over what it was before, since one of the objects of such payment is to lower the cost of production. Saving in direct labor cost through increased production may often be given entirely to the workmen where the proportion of overhead to total cost is high, or may at least be shared equally between management and men. Just how much we can afford to pay

as a reward over regular wages for a specified output must be accurately figured out in each case.

In connection with the reward for the exercise of qualities which the standard is supposed to bring out and measure, it must be remembered that there are two kinds of effort which in certain cases may seem to be antagonistic, yet which in every case it is extremely desirable and often indispensable to develop. The next

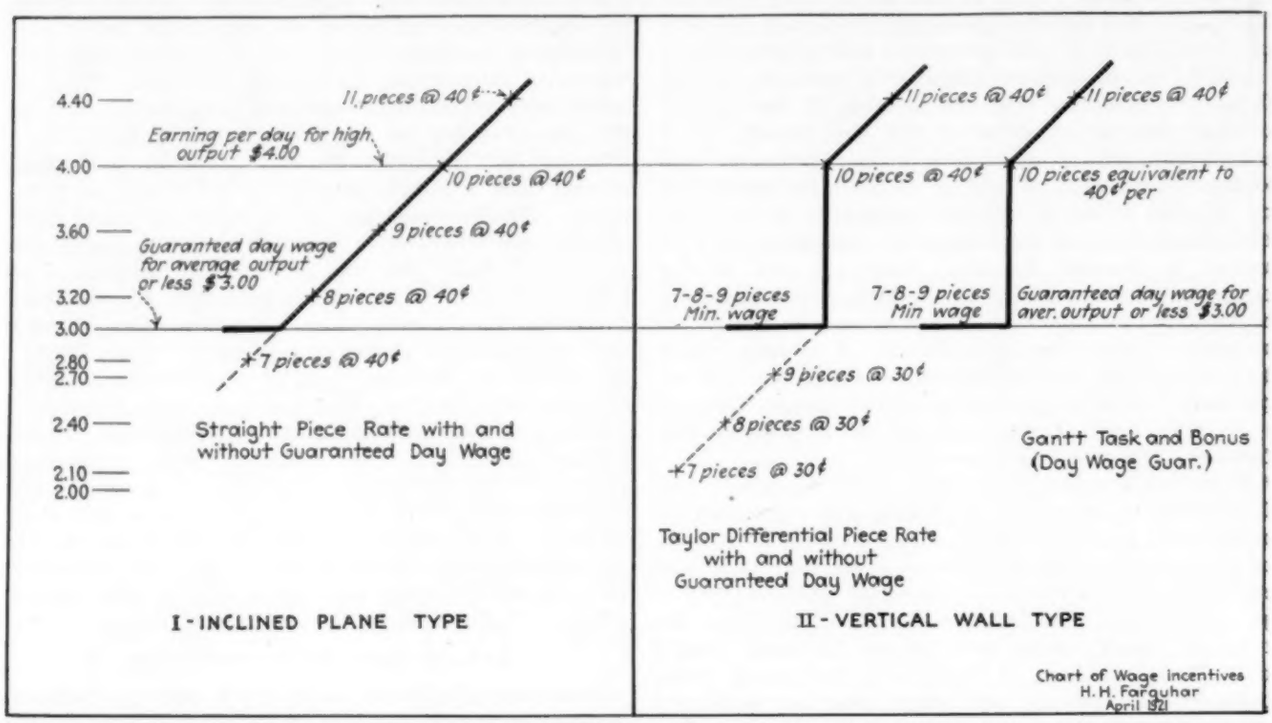


FIG. 1. THE TWO TYPES OF INCENTIVE WAGE PAYMENT, ILLUSTRATING THE ADDITIONAL "PULL" WHICH THE VERTICAL WALL (TASK) TYPE HAS OVER THE SLIDING SCALE TYPE. THE WORKMAN DOES NOT HAVE THE OPPORTUNITY WITH TASK WORK TO BE CONTENT WITH MEDIOCRE EARNINGS BECAUSE NONE ARE PROVIDED FOR: HE MUST GET ALL THE WAY TO THE TOP WHERE HE GETS A BIG REWARD, OR ELSE ACCEPT ONLY THE REGULAR DAY WAGE

two topics cover these two kinds of effort—individual and collective.

(9) *The reward, in the first place, must be dependent on individual effort.*

Whiting Williams[1] has brought out forcibly the desire of the workman (or of any other normal human being) for individual as well as group recognition and reward. Although we are essentially a gregarious people, our desire for the welfare of the group is founded, I believe, on an enlightened self-interest in the welfare of the individual *ME*. Certainly this desire for a feeling that we individually are a going concern irrespective of our relation to a particular group is not only worthy of development, but is of such a fundamental nature as not to be capable of suppression. Each man should be made to feel that he can in some way through his own individual efforts affect the quality or quantity of production, or both, and if so then through the operation of the payment plan each man must have individual opportunity, responsibility, recognition and reward for so doing. Otherwise it is not clear that he should be included at all in the group of incentive payment workers.

This requires that the method of rewarding high production, no matter what it is, shall provide as the fundamental basis that the accomplishment of each individual workman, so far as possible, be reflected on the record of that individual, through the pay envelope or otherwise. In many kinds of work, such as riveting, for example, it is impossible or impracticable to measure the performance of each member separately from the performance of the gang as a whole. As a corollary to this rule, however, should be added the requirement that there should be as few men working interdependently as possible and that where gang work is necessary the gang should be small and treated as a separate unit for the determination of efficiency of performance. Each workman or gang, furthermore, should if possible be recognized in direct proportion to actual performance in so far as this performance is within the power of the worker to influence, regardless of *all* other factors which he cannot influence, such as volume of work provided through the sales department, interruptions to the flow of work due to poor purchasing or planning, the shortcomings of inferior fellow workmen, and so on. In other words, the result of the exercise of his own abilities should be kept entirely distinct from the net results due to the dependent sequence of his own and others' ability or lack of ability.

Since not only individual initiative but also team play and co-operation are desired, it is often advisable to supplement the individual reward with another in proportion to the work of the group, department, or plant as a whole. The suggestion is therefore made:

(10) *The reward, in the second place, should be dependent on group effort.*

There should be an additional reward for departmental co-operation, according to the degree to which the department as a whole attains the standard set for it, so as to make it to the advantage of each man not only to do his own work properly but also to see that every other man does his share and to be of assistance

[1]Whiting Williams: "What's on the Worker's Mind," *Scribners'*, 1920.

in helping others wherever and whenever possible. The measure of the whole department's performance is the sum of the respective performances of each individual within the department, and the reward usually takes the form of an additional sum of money which is proportionate in amount to the degree to which the department standard has been attained, this sum being divided on the basis of regular earnings or otherwise among those employed, and constituting a payment in addition to and on top of each man's individual earnings through his own individual work.

The net result of adhering to recommendations Nos. 9 and 10 is that we have two incentive payments instead of the customary one, each distinct and each based on production delivered, but one pertaining strictly to individual while the other pertains strictly to group efficiency.

In order that the respect of the workmen for the incentive appeal be continuously retained, two additional measures must be incorporated in its operation —both very obvious but both rather difficult to enforce in practice because of the tendency to relax under pressure. These are given in the two following rules:

(11) *The reward should be attainable only by persons who, after the necessary period of training, prove they are first-class operatives at the particular work.*

The reward must not be cheapened through its easy attainment. As stated in the preceding article, topic 4, the standard itself should be a high one, not easy of attainment except to one who is really fitted for the work to which it applies and even then the reward should not come too soon.

All incentive methods of pay may be classified from the psychological standpoint into two groups: One the *inclined plane* where the reward is placed in small installments up along the incline so that the workman may pick up a little at each step as his performance increases, the other the *vertical wall* type where a large lump sum reward is placed on top of the wall and the workman gets none of it unless and until he gets clear to the top. These two types are illustrated graphically in Fig. 1. The straight piece rate is an example of the former, the Taylor differential and the Gantt task and bonus are examples of the latter. My experience with various methods has demonstrated two outstanding advantages from the standpoint of the management which the vertical wall type (task work) possesses over the inclined plane or sliding scale type: first that the task tends to pull a man up to high production sooner and hold him there more consistently than is the case with other methods, and second, that if the task is properly set for men adapted to the work it furnishes an accurate if not the only reliable means of fitting the man to the job, since one who, after a reasonable period of training, proves he is not fitted and does not scale this particular wall, may be transferred and trained until the class of work on which he can go over is found. It is usual, of course, to guarantee a specified minimum day's pay during the period of training and probation.

The stipulation that in any given case you must be a pretty capable man to earn consistently the additional reward offered, creates an aristocracy for each class of work which seems in many cases to mean as much to the men as does the extra pay they get for "belonging."

(12) *The reward must be allowed only on work up to required quality.*

This rule is so manifestly evident that it is unnecessary to point out what will happen if it is not enforced strictly to the best of one's judgment. The difficulty comes through the fact that quality is a relative matter, depending in the last analysis on what someone says is sufficient under the particular circumstances. Where incentive payment is backed up with adequate inspection, however, it has been found almost without exception, so far as I know, that the quality of work actually improved over what it was before.

It follows from rules (11) and (12) that with the vertical wall plan extreme care must be exercised in allowing a reward which was, for any reason, not actually earned when the work was done. Corrections of poor work of any kind should ordinarily be made on the workman's own time. A strict policy in this respect exerts a bracing effect on the management.

Finally, to enforce all of the preceding rules, particularly the first and most important of the lot, one last requirement as regards type of reward must be fulfilled:

(13) *The plan of reward must bring pressure to bear upon the management for the proper discharge of its duties.*

Whenever anything goes wrong and a man, after once getting up to standard, fails to earn the additional reward offered, this fact should become known at once at headquarters, just as when we step on a nail we are notified immediately that something is wrong below. If the workman's failure is due to shortcomings on the part of the supervisory force there is no fact which the sympathetic management should be more eager to know, and the operation of the plan of reward should provide an automatic messenger service in this respect. In other words, the workmen should suffer in some degree for the mistakes of the management as well as for their own for the admitted purpose of making them bring pressure against the offending official. One of the shortcomings of the straight piece rate method of pay is that a man's failure to get to the top is not brought forcibly to the attention of the management, since he usually accepts his small financial loss (due to doing eight or nine instead of the standard ten pieces) rather than make a fuss. With the vertical wall type of plan, however, his financial loss is so large that if the fault is not his own he is pretty sure to be heard from—which is exactly what his superiors should desire. It is a courageous management which will deliberately adopt this policy and take the resulting knocks, but it is simply one of those give-and-take features of incentive payment upon which mutual confidence and success is based.

Ideas From Practical Men

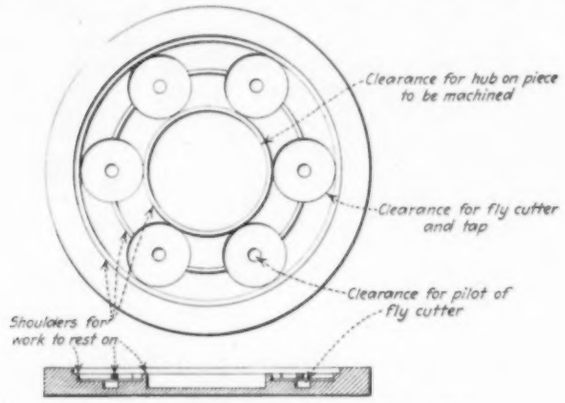
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How Would You Machine This Disk?

BY RICHARD F. MOORE

On page 959, Vol. 54, of the *American Machinist*, P. Arter shows a piece to be machined which is exceptional to say the least. But I think it can be machined most satisfactorily in the following way:

The rough disk should be machined on the outside diameter to the correct size and shape first. This


Clearance for hub on piece to be machined
Clearance for fly cutter and tap
Clearance for pilot of fly cutter
Shoulders for work to rest on

FIXTURE FOR HOLDING THE DISK

could be done with an end mill on a vertical spindle milling machine by strapping it on the table.

Next its straightness should be verified so as to be sure it will "clean up" at ⅞ in. in thickness. Then procure a piece of steel or cast iron and machine it all over as shown in the illustration. This piece will serve as a fixture for holding the work while machining. Said fixture can be left strapped on the faceplate of the lathe where it was machined. Remove faceplate and lay flat on the bench with fixture on the top. Then apply heat by the aid of several blow torches until it is hot enough to melt beeswax. Enough beeswax is then put in to fill it a trifle above the shoulders.

The piece of brass to be machined, which has been preheated so as not to cool the wax too much, is then placed in the fixture and care must be taken that there are no bubbles or air under it. The whole idea of this holding arrangement is that the piece is allowed to "float"; that is, there are no strains on it when the wax cools and hardens. Consequently, when the piece is removed, it will maintain its straightness when it has been machined. I doubt, in fact I don't believe, this piece could be held with any kind of clamping fixture without distorting it.

I think that the side with the hub on it should be machined first. I should say that the tapped holes should be put in next, before removing after machining the first side. That could be done on a drill press by driling ½-in. holes first where the big holes are going and then use a sort of fly cutter with a ½-in. pilot. Most mechanics are familiar with this tool which is often used to make disks.

The tapped holes are of extraordinary dimensions—5½ in. diameter and three threads in length. But I think the job could be done with the right sort of tap and by taking great care. It could be done in drill press while the work is located for boring the hobs.

Of course the boring could be done in a lathe if there was one large enough on hand, but I'll assume there is not. After machining, the disk can be reheated and turned over, and this time care must be taken that it rests on the shoulders of the fixture all over; and if it does it is bound to come parallel.

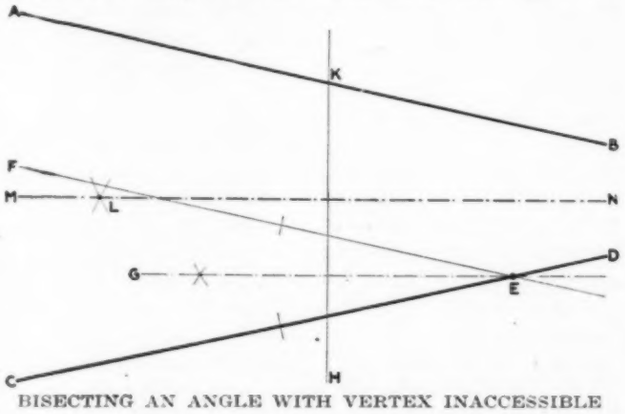
Its straightness after removing will depend on the care taken not to create any strain by heavy cuts, etc. The cuts can be measured by scraping away a little of the beeswax in one of the tapped holes and using a depth micrometer, the depth of the clearance hole being previously measured.

After the last cut has been made the fixture and all can be located on a vertical spindle milling machine and the six slots machined. The other holes can be drilled and countersunk in a drill press. The trouble with this job is it is light work, but it must be done on large machines, being of such extraordinary dimensions. It makes no difference how I go into detail, the job requires the services of a first-class mechanic.

Bisecting An Angle Whose Vertex Is Inaccessible

BY W. S. AYARS

This is a brief solution of a geometrical problem that came up one day. While there is nothing hard about it, it may be that many shop men have run



BISECTING AN ANGLE WITH VERTEX INACCESSIBLE

against the same problem and did not know how to solve it quickly:

Let *AB* and *CD* be two converging lines, whose intersection is inaccessible, and the angle between which it is desired to bisect. At any point *E* on *CD*, draw *EF* parallel to *AB*. Bisect the angle *FEC* in the usual manner, by *GE*. At any convenient point *H* draw *KH* perpendicular to *GE*. With any convenient

radius and center at K and H strike arcs intersecting at L. Through L draw MN parallel to GE; MN bisects the angle between AB and CD. The reasons why are so simple that they need not be stated.

Economy in Cutting Drawing Paper

BY WILLIAM H. KELLOGG

The factors that generally determine the sizes of sheets upon which drawings are made, consist of convenience in handling, conformity with filing requirements, conformity with the nature of the work represented and economy in using the paper and tracing cloth.

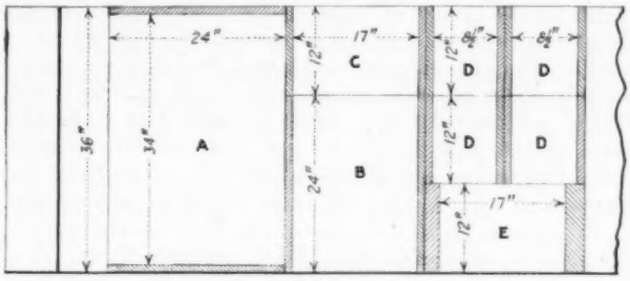


FIG. 1

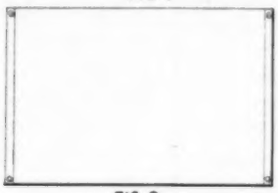


FIG. 2

FIGS. 1 AND 2. ECONOMICAL SYSTEM OF DRAWING SIZES

A plan which the writer has used on his own work is to make the two dimensions of the sheet such that the different sizes in the same system will always be in proportion to each other. The rule for determining such a proportion is to multiply the smaller dimension, or divide the larger by the square root of two, which is 1.414. Thus, if the smaller dimension is 8½ in., the other would be found by multiplying 8½ by 1.414, which equals 12.019, and disregarding the small fraction, 0.019, we get a sheet which is 8½ x 12 in., which would usually be the smallest size in the system, and the sizes would then be as follows: 8½ x 12, 12 x 17, 17 x 24, 24 x 34, 34 x 48 inches.

The dimension of 12 in. and its multiples makes it easy to conform to the usual widths of paper and tracing cloth, the most common width being 36 in. The smaller dimension, 8½ in., being the same width as a standard sheet for letters, makes it convenient to use the smaller size drawings in connection with correspondence, and if an inch of margin be reserved at the end of the sheet for binding blueprints in book form, this margin can be cut off when the sheet is to accompany a letter as the size will then be 8½ x 11 in., which is identical with the standard letter size.

The illustrations show how sheets for drawings may be cut in a most satisfactory and economical manner from paper or cloth of the width mentioned above. In Fig. 1, the shaded portions represent the margins of paper that are usually left on the piece on which the drawing is to be made, to be later trimmed off in order to bring the adjacent edges at right-angles to each other. These margins also serve as a space in which to place the thumbtacks, and to test the drawing pen in the usual manner of draftsmen. Some draftsmen prefer to have such a waste margin on all four sides of the sheet, but by taking care in cutting the first two edges, it is not necessary to have more than two edges for trimming, especially with tracings. However, the plan here shown would not hinder anyone from leaving four edges if he so desired.

A sheet 24 x 34 in. in size is represented by A, Fig. 1. B and C represent two sheets, 17 x 24 in., and 12 x 17 in. respectively, that are to be cut from a section the full width of the roll. The four sheets shown by D and the one sheet shown by E are also all to be cut from a similar section. It will be observed that six sheets the size of the D sheet, or three the size of the E sheet, could just as well be cut from the same section, but the illustration is intended to show how easy it is to get a number of varying sizes of sheets, when one size throughout is not desired at the time of cutting.

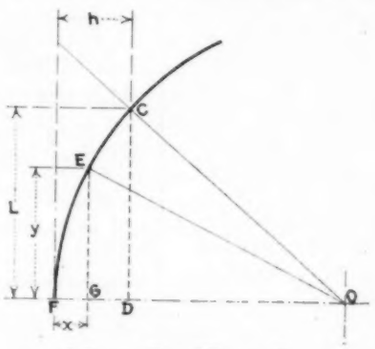
The two margins are, of course, left on the sheet until it is finally trimmed after the drawing is finished, and Fig. 2 shows how the sheet shown at A in Fig. 1 is tacked down to the board, the margins for trimming being at the sides only. It will be seen that on some of the other sheets shown in Fig. 1, the margins would be at the top and bottom instead of the sides, provided the long edges run horizontally as in Fig. 2.

It may be noted that the waste margin on the E sheet is larger than would be necessary if the D sheets were not cut from the same section. Hence it is desirable to cut as many sheets of one size as can reasonably be done at one time.

Laying Out a Circular Arc When Center Is Unknown or Unavailable—Discussion

BY GEORGE WARMINGTON

The solution of the problem of laying out a circular arc when the center is unknown, as given on page 112, Vol. 54, of the *American Machinist*, is much more difficult than is necessary. A shorter method is as follows:



$$OC = R \quad CD = L$$
$$OD = R - h$$

From triangle COD

$$R^2 = (R - h)^2 + L^2$$
$$R^2 = R^2 - 2Rh + h^2 + L^2$$
$$R = \frac{L^2 + h^2}{2h} \text{ and } R^2 = \left(\frac{L^2 + h^2}{2h}\right)^2$$

Also, $EO = R$ and $FO = R$

From $\triangle GEO$, $x = R - \sqrt{R^2 - y^2}$

By substitution, $x = \frac{L^2 + h^2}{2h} - \sqrt{\left(\frac{L^2 + h^2}{2h}\right)^2 - y^2}$.

IN THIS ISSUE

DURING the several recent years when production was the essential thing, shop methods and systems received the larger part of the attention of everyone. At the same time there was demonstrated the importance of the personnel in industry. A system might be perfect yet it would not produce proper results of itself; it had to have back of it and operating it correct management from president to foreman. It may be that some writers and investigators have recently overemphasized the importance of management and personnel relations in industry, but even so they should receive little blame for their zealous attempts to improve what is known to be weak in many ways. Now that we no longer have the incessant demand for immediate production more careful attention is being given to training and developing the personnel. Managers are studying themselves and their organizations, superintendents are realizing more than ever the importance of those ranking below them, and so it goes all along the line. The result is going to be that when we get back to the point where the orders are coming in regularly, management is going to have a much clearer realization of its own possibilities.

Each plant has its own management and personnel problems which it is up to the organization of that plant to work out. But management problems may be very properly generalized, the generalizations forming guides for the solution of specific problems. Such guides are available in the form of articles in the engineering and technical press. The *American Machinist* is carrying this week three such articles: Training Leaders for Foremanship Classes, by D. J. MacDonald; Incentive or Production Basis of Wage Payment, by Henry H. Farquhar; and Organization and Management of the Small Shop, by Elmer W. Leach. The MacDonald article is the first in the issue, the Leach article begins on page 262 and the Farquhar article will be found on page 275.

The second article of Chubb's short series on machining the Wrigley automobile transmission gear shows how mechanical conveyors are used to eliminate handling, indicates the routing of parts through the machine shop and describes inspection methods and tools for both roughing and finishing component parts.

Once again we are furnishing more than we properly should of Tool Engineering. The installment this week takes up the design of profiling fixtures, and the subject is so absorbing and so full of opportunity for ingenious and economical arrangements that we simply couldn't stop it off in our usual three and a half or four pages. There are included this week, beginning on page 256, data on cam milling, machining irregular forms, methods of roughing and finishing, the use of multiple fixtures, and very briefly, the types of profiling machines.

Beginning with 267 there are four pages of the fourteenth of DeLeeuw's Metal Cutting Tools. You will remember that this article takes up the use of liquids when cutting metal, showing when liquids should be used for lubrication, for cooling, and for washing out chips.

A variable speed and feed control system known as the "Oilgear," developed by the Oilgear Company, Milwaukee, Wis., is described in the article beginning on page 271. This system embodies the application of hydraulics to speed and feed mechanisms.

Several months ago we announced the death of William D. Forbes who has for a number of years been a contributor to the *American Machinist*. At that time we had on hand two or three articles by Mr. Forbes one of which has been prepared and is presented herewith, page 284. "How A Blind Man Makes Drawings," explains how Mr. Forbes, who was a designer and draftsman before he became blind, continued his work by the use of a typewriter and later by dictating his drawings to his daughter.

A welcomed article will be the twentieth of Modern Production Methods, "What Does it Cost to Sell?" page 286. After reading so much about the cost of producing a commodity it is a relief to get into this article of Basset's. His opening gun is the statement: "Profits more often fail to materialize because it costs too much to sell than because manufacturing costs are too high." It appears to be a big caliber gun and there will be some who will think he is wasting ammunition. But not so! It is going to take big guns to stir up the proper realization of the cost reductions that are going to be necessary to meet the competition that is coming.

Coming Features

The series on economics, about which there was a brief foreword last week, will begin in our next issue. There will be ten installments, no one over two pages in length. Accompanying the first will be an introduction to the series by Ernest F. DuBrul, General Manager of the National Machine Tool Builders' Association. The author is Prof. D. A. McCabe, Ph.D. The general title is "Economics of Production," and the sub-title of the first article is "Demand and Production."

Tool Engineering and Metal Cutting Tools are to be the other series articles in the next issue.

The complete articles will be five in number, two of them by Colvin and one each by MacNab Mawson and Hunter. They treat of the making of drag saws, the manufacture of automobile pistons, grinding fixtures, shop work on locomotive cylinder and valve parts, and the handling of materials in an automobile plant.

EDITORIALS

Indiscriminate Buying

THERE are two kinds of indiscriminate buying. One is to buy everything in sight regardless of price; the other to buy as little as possible and at the lowest price, regardless of quality.

Our boom period gave us shining examples of the first method. As a result many firms are still overstocked with machines and tools for which they have no immediate use. We recently saw a list of twist drills sent out by a large user to the makers of twist drills. It was a list of thousands of dollars worth of new drills. The customer wanted each maker to take back the drills of his own make, at the current price, to be either paid for or credited against future orders.

Such a condition is far from encouraging to makers of drills and comes from indiscriminate buying a year or more ago.

As a reaction to this we have a return of the old type of purchasing agent in some quarters. He was aptly described, years ago, as the man who "knew the difference between ninety-nine cents and a dollar—and that's covering every d—— thing he does know." This tendency to buy on price alone is becoming apparent in places. The inefficiency of it hardly needs comment. It means limiting the output of a ten-thousand-dollar machine to save a few dollars on cutters. It means increasing the cost of production at a time when lower manufacturing costs are imperative.

The banker too, at times, is playing a part in delaying the return of normal buying. In one instance a firm wanted to buy a new machine which would make a considerable saving in the cost of production. It had the money available and believed it a wise investment. But the banker on the board vetoed the purchase—the bank was not encouraging any purchases of new equipment, no matter how efficient.

This "sit tight" or "stand pat" attitude is not helping to restore business to normal. And the failure to buy may be called just as indiscriminate as the failure to buy properly.

The way to resume business—is to resume—as Horace Greely said so many years ago regarding currency. Waiting for George to buy first doesn't help business in the least.

What Is Normal Business?

WE HAVE reached the stage where we can measure length within limits of millionths. We can weigh the scratch of a pencil on paper by means of a good chemical balance. We can test materials physically to extremes of accuracy. But to do so we must first establish standards with which to compare the things we measure, and to do this is one of the most difficult of tasks. So much so that there has been for years a government agency devoted to the purpose.

But if the determination of a physical standard is hard, that of a standard for volume of business is infinitely harder. If business were governed by laws as inflexible as those of natural philosophy and every business man were compelled to keep close records of all his transactions, it might be possible to arrive at some common point upon which to base comparisons; but as it is, the only alternative is compromise.

Ask a man how his business is and ten chances to one he will say, "rotten." If you pin him down to figures he may say that he is doing about twenty-five per cent of normal. This sounds most discouraging until you inquire as to what he considers normal and then you are more likely to learn that "normal" was the peak of his wartime production. If you are sufficiently inquisitive to trace the records back to 1910, '12 or '14 you may even find that he is doing more business now than he did then. Allowing for normal growth every going concern ought to be doing more than it did ten years ago, but when we consider that we are in the throes of reconstruction following the greatest war of history, it would almost seem that a man might be satisfied to hold his own.

We must not lose sight of the fact that many companies have no reliable records of the volume of business done before the war—they may have been too small or too badly run. Every statistician is up against this snag and we consequently find that 1919 has to be taken as the standard year for some products because the earliest figures available are those for that year.

Let us not be too hasty, then, in accepting production percentages as unassailable until we are sure of what they are based on. The times are hard enough, in all conscience, without making them worse by bad arithmetic.

Honoring an Engineer

THERE are many instances where the engineer behind an industry, whose ingenuity and training have made success possible, remains hidden and unknown, while the man with the check-book receives and appropriates all the glory as well as the financial rewards. It is, therefore, particularly gratifying to note the action of the Franklin Automobile Co. in proclaiming to the world its indebtedness to John Wilkinson, the designer of the Franklin car and the engineer whose perseverance made the air-cooled motor a successful commercial proposition after so many had failed and abandoned the idea.

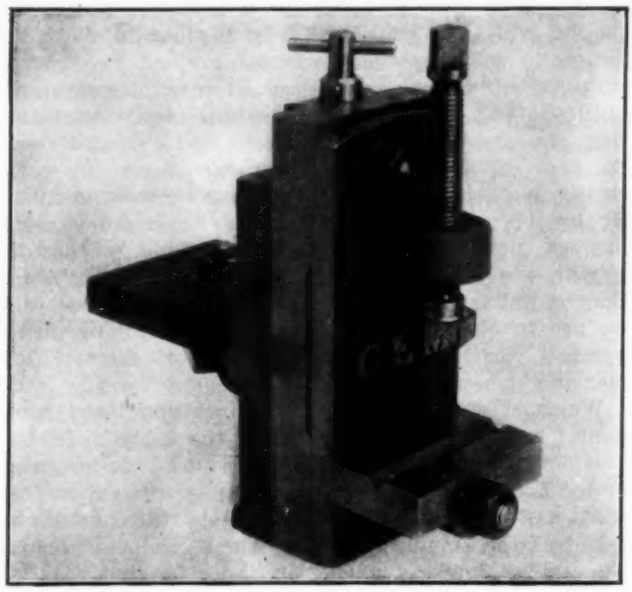
In a neat little booklet entitled "In Honor of John Wilkinson" issued on the twentieth anniversary of the Franklin car, is the story of the development and the perseverance which made it a success. A brief outline of the development is given as is full credit for the achievement. Other engineers, of course, added the results of their experience, but to John Wilkinson belongs the major credit for the success achieved.

If more concerns followed this practice of publicly crediting their engineers and designers with their successes, there would be a much greater feeling of loyalty than now exists in too many instances. The sooner large concerns learn that in honoring their engineers they also honor themselves, the better co-operation they will receive.

Shop Equipment News

Kiddle "Gem" Milling Attachment for Lathes

The Richard H. Kiddle's Machine Tool Works, Kinsman, Ohio, has recently placed on the market a device, shown in the illustration, for attachment to lathes to



GEM MILLING ATTACHMENT FOR LATHES

enable the performing of milling operations. It is said to fit most lathes from 10 to 17 in. swing, the toolpost being removed and the attachment secured in its place. A tie bolt can be furnished to fasten the attachment to the cross-slide when it is used on the Gem lathe.

The device holds the work to be cut and is provided with adjustments to permit of moving it relative to the cutter. An arbor, 12 in. long and made to hold a 1-in. B. & S. cutter, is furnished. The outfit is said to be particularly useful in a garage or jobbing shop for performing small odd jobs of milling. It is said to be capable of cutting keyways ⅞ in. wide, or even wider, and 7 in. long without re-setting. The taper ends of automobile axles can be squared and the keyways cut by the use of the device.

Cochran "Metaloid"

The Cochran Metaloid Co., Moffat Building, Detroit, Mich., has recently placed on the market a material known as "metaloid," for use in repairing holes and cracks in metal. It is especially intended for use in garages for repairing cracked cylinder heads, water jackets and transmission cases, although it can be adapted to the repairing of pipes, tanks, radiator connections and similar parts.

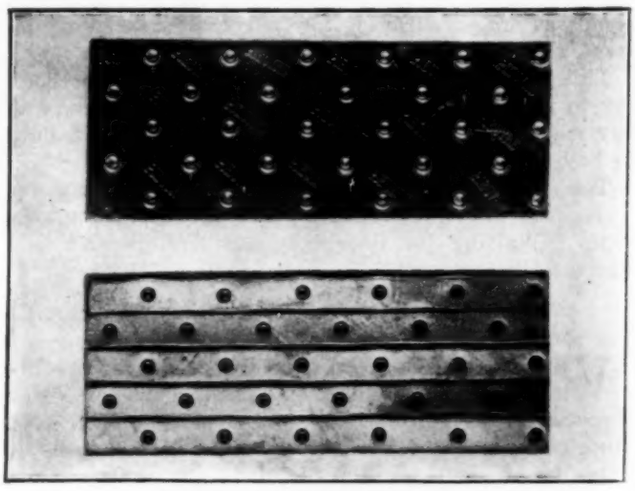
It is stated that the metaloid will fluxate with any metal that can be heated, including aluminum, brass, and gray and malleable iron. The part to be repaired is first cleaned of all oil and grease and then heated to about 200 deg. F., usually with a blow torch. The metaloid is then rubbed into the crack or hole, the parts allowed to cool, and the excess material filed off. It can be applied from the side or beneath, as well as above.

The metaloid will, after solidifying, withstand a pressure of 250 lb. per sq.in. and a temperature of 600 deg. It is not to be used where a high tensile strength is required. It is said to enable the making of permanent repairs very quickly. The heat required for its use is not sufficient to warp cylinders, as might occur with welding.

"Pieuvre" Belting

The accompanying illustration shows the two sides of a type of belting which is the invention of M. H. Guillou, of Paris, France, and which is now being put on the American market by J. L. de Rabot, 191 Greenwich St., New York, N. Y. The chief claim made for the belting is its great power of adherence, without the use of adhesive belt dressing or of idler pulleys. The belt combines the use of oak-tanned and chrome-tanned leathers, the latter being in contact with the pulley. The oak-tanned leather, such as ordinarily used for belting material, is valuable because of its tensional strength, its resistance to wear and the facility with which joints may be made. Its power of adherence, as to a polished cast-iron pulley, is stated to be much less than that of chrome-tanned leather, which has but little tensile strength.

In the combination of the two kinds of leathers, the oak-tanned material takes the pull and the chrome-tanned gives the adherence. The belting consists of oak-tanned leather or, in some cases, of a "Balata" backing, to the under-surface of which are attached narrow longitudinal strips of chrome leather. These strips are held in position by means of hollow brass



PIEUVRE DOUBLE BELTING

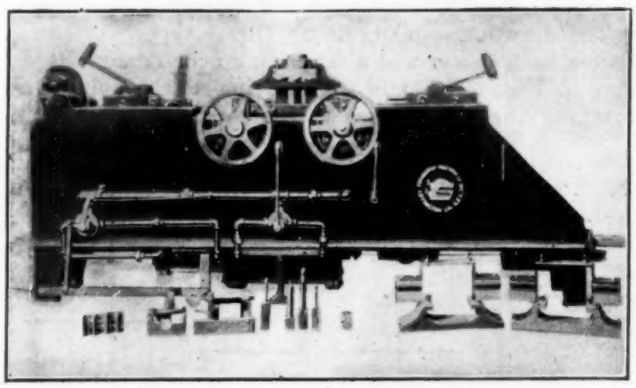
rivets, the heads of which project above the outer surface of the belting, and which are clenched well home on the under side into the chrome leather. The depressions surrounding the rivet ends, combined with the blind holes in the rivets, are said to act as suckers during use and to augment the adherence. The name

of the belt, meaning "octopus," was given because of the gripping action.

The advantages which the high co-efficient of friction give to the belt are, of course, that it can be run at a lower tension, thereby avoiding excessive wear and tear on bearings and shafting, while the work of the belt is practically all useful effort. Only tallow is used as a dressing.

Covington Hose Machine

The machine shown in the illustration has recently been placed on the market by the Covington Machine Co., Covington, Va., for assembling and dismantling hose. It is intended especially for use in railroad shops for work on air brake, signal and steam hose, replacing hand methods of performing such work. It is



COVINGTON HOSE MACHINE

claimed that the machine does not damage the fittings and clamps when assembling or dismantling, permitting of a saving in this regard. The work is said to be better than that performed by hand, and to be done at a great saving of time and labor. It is stated that on a test run one man dismantled 100 air hose in one hour, and assembled 25 of them ready for service in the same length of time.

The illustration shows the entire equipment of tools required for performing the complete range of work. The change from any operation to another is said to average less than two minutes. Air and signal hose are handled by the same tools, except the nipple puller, which it is said, can be put in place within ten seconds. To change from air and signal hose dismantling to steam hose dismantling requires less than one minute, it is said; to equip the machine to strip short ends of air and signal hose, less than three minutes; from air and signal to steam short ends, less than ½ minute; and to change from dismantling to assembling, less than ½ minute In assembling fittings into new hose, no injury can result to the hose, as it is held rigid without clamping.

Foundry Building at an R. A. F. Depot, England

By J. B. Nelson

During the World War the British Air Service organized repair depots all over the country, to which were sent damaged air machines and engines to be made fit for service.

These depots were complete engineering establishments, having shops for all the various trades, well equipped with every appliance and well supplied with skilled mechanics who were all enlisted soldiers and under military law.

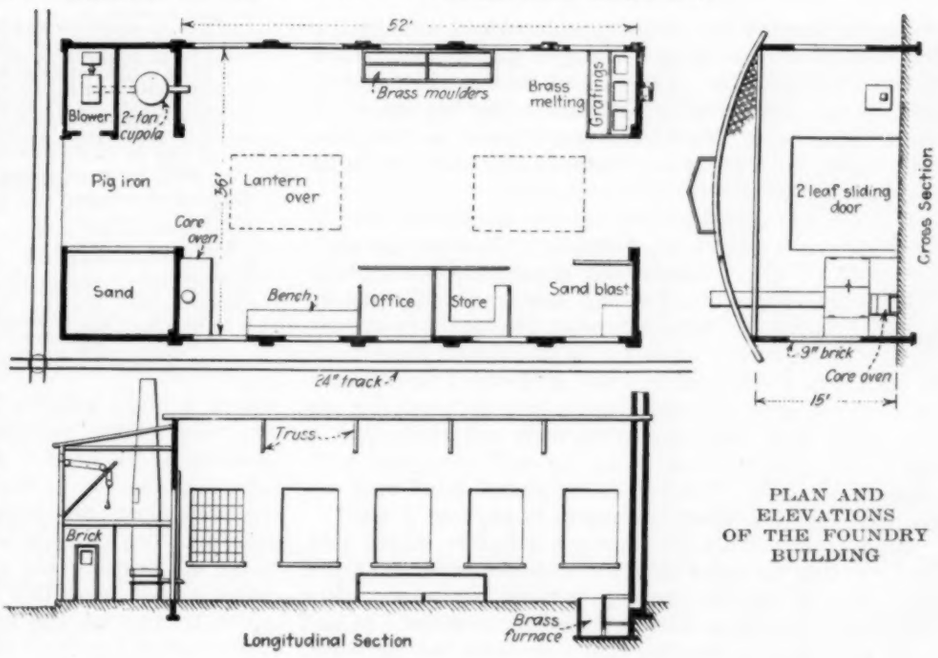
The following description of a foundry building at one of the depots may be of interest:

Castings in iron, brass and aluminum were required, as well as a general run of machine-shop castings. No castings of great weight were ever needed, as no repair parts weighed over 100 lb. All the equipment, with the exception of the motor and blower, was made at the depot—the cupola was built from a second-hand steel chimney stack and ore was raised to the charging platform by a hand hoist. The core drying oven was of sheet steel with the usual shelves, and was set on a brick foundation in which was provided a fire grate. The brass furnaces were of standard type, fired from below, and had provision for three crucibles.

The building shown in the illustration was of brick with roof carried on "Belfast" timber-trusses and had two lanterns. The interior was well lighted and proved to be ample in floor area for the work to be done.

The management of the plant was vested in a commissioned officer, who was solely responsible for the quality and quantity of the castings turned out, as well as for the conduct and general discipline of the men employed. He was aided by two non-commissioned officers who directly supervised the work of the molds.

Nine molders of different grades were constantly employed and their rate of pay was graded according to their experience and skill. The wages paid varied from four to eight shillings per day.



PLAN AND ELEVATIONS OF THE FOUNDRY BUILDING

How a Blind Man Makes Drawings

Visualizing Machine Parts and Movements—Drawing on a Typewriter—Dictating Drawings to a Draftsman—Describing Machines and Drawings

By WILLIAM D. FORBES

"NEEDS must when the devil drives," is an old saying and the engineer who finds himself in a position where the tools are lacking to carry out his work, has often to get up some makeshift to help him out, or else acknowledge himself beaten, something no one likes to do. When I suddenly became blind some few years ago I thought that my days of designing and drawing were over, but inactivity was far from my liking and my inclination to design machinery could not be stopped by blindness. I had for years worked on machine guns and, a new idea coming to me while sitting in darkness, I began to visualize the parts. After a while I had the conception of each piece firmly fixed in my mind, and I determined to have a drawing made of the weapon. Most fortunately for me, I have a daughter who knows how to use drawing instruments, as I had taught her to trace for me. I dictated to her my ideas, and a model gun was made from her drawings. The arm functioned, not perfectly, of course, but well enough to show me that the design was worth while developing further.

One thing that very much surprised me at first was the fact that I could make far better progress in dictating drawings to my daughter than I could if I employed a skilled draftsman. This fact is easily explained, however. With my daughter, no line was made except as I dictated, so that I knew exactly where I was. A trained draftsman would get ahead of my dictation, as he knew perfectly well that a further line would be needed and he would lay it in. Then I would be at sea, as I might tell him to number the last line I had dictated, and he would put the number on the last line he had made.

Learning to Use a Typewriter

Having learned with little trouble to knit articles for our boys across the seas, I thought that I might learn to use the typewriter. I got a book on the touch system and, to my astonishment, I learned the key board in about three days. Now I can write about as fast as a fair typist, and of course they are all fair—at least they and their male friends think so.

I do not use raised letters, but use my fingers just as do typists who have eyes, depending like them on position only. I did, however, put some little sealing-wax dots on the letters *t* and *y*, and also on *g* and *v* and on *a* and *l*, as these letters located the position of my fingers on each row. After a while I found these indicator points of less and less use, and now I do not need them at all, although they were a help at first. Let me say right here that the often-made assertion that a blind man can do some things as well as a man with sight is all bosh. The only thing that a blind man can do perfectly is to sleep. Asleep he is anybody's equal.

As I could not always have my daughter at my side, and wanting to make details which she could take and assemble, I started trying various ways to make sketches. I could make but little progress until at last I hit on a plan, employing the typewriter for my work. A detail drawing so made is shown in Fig. 1. The sketch would be worthless without the text that goes with it, just as it would be if the figures were not put on it. Here is demonstrated the fact that a blind man can not do any work as well as one with eyes, as the text takes time to read, so that time is lost. Yet, I think that any mechanic will say that with the sketch and text there would be no trouble in producing the piece or pieces.

Drawing on a Typewriter

The drawing is made on an Oliver typewriter fitted with a back spacer and a tabulating pencil arm. Referring to Fig. 1, I began the drawing at the point *a* by bringing the pencil down to the paper. Then I back-spaced a given number, arriving at the point *b*, turned the roller of the machine a certain number of notches, arriving at the point *c*, and fed the pencil along the line by the spacer bar to the point *d*, counting the spacings to make them the same in number as the first back spacing. The point *d* was directly under the starting point *a*. Turning the roller over one notch gave the point *e*, and from this point I retraced the track one notch by turning the roll towards me.

Remembering the number of notches I had revolved the roller from *b* to *c*, I clicked the roller that number

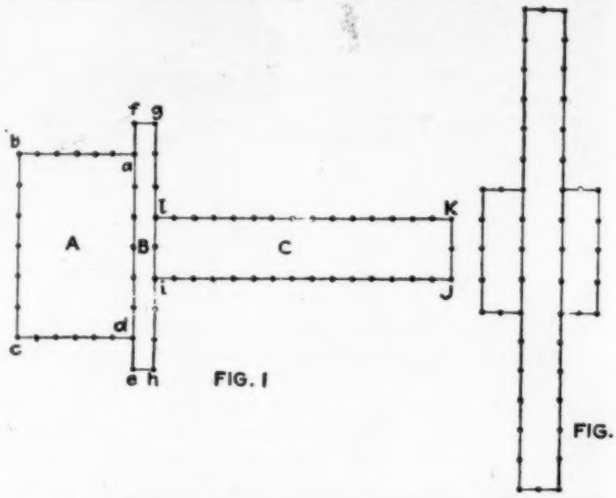


FIG. 1. DETAIL DRAWING MADE ON TYPEWRITER, WITH ACCOMPANYING DATA

Material, mild steel.
Number wanted, 2.
A is ½ in. in diameter and ½ in. long.
B is ⅝ in. in diameter by $\frac{1}{16}$ in. thick.
C is ¾ in. in diameter by 1⅛ in. long.
A is to be a light drive fit in the steel tube sent.
B fits nothing and is just a collar.
C is a nice running fit in the steel gear sent.
In the end of *C* a small hole is to be drilled and tapped. A round-head screw must be provided, also a brass washer ½ in. in diameter and $\frac{1}{32}$ in. thick, with a hole in its center to fit the screw.

FIG. 2. EXAMPLE OF DICTATED DRAWING

Material, aluminum.
Number wanted, one.
Make pattern, set no core.
Diameter of pulley, 3 in.
Face of pulley, ⅝ in.
Hubs project, ¼ in.
Diameter of hub, ⅝ in.
Length of hub, ⅝ in.
Hole in hub, ⅜ in., reamed.
In the face of this pulley a semi-circular groove is to be cut, ¼ in. deep and ¼ in. wide.
Finish all over, but do not polish.

to arrive at the starting point *a*. Going one notch further gave *f*, and one pressing of the regular spacer brought the pencil to the point *g*. One click of the roller brought me to a point just to the right of the starting point. By continuing to turn the roller and to count the clicks to make them equal to the number from *b* to *c* with one additional gave the point *h*, and one back space gave the point *e* again. Returning to *h* and turning the roller one click towards my left put the pencil just opposite the point *d*. As I remembered that the number of spaces or clicks of the roller from *b* to *c* was six, I clicked twice, giving the point *i* on the line *g-h*. By fifteen spacings on the spacer bar, the point *j* was reached. Two clicks on the roller gave *k* and fifteen back-spacings *l*. It was a simple matter to put the letters *A*, *B* and *C* in their places. The sketch was then complete. The small letters I did not put on, as they are not required for making the part.

Concentrating on the Work

This description would seem to indicate that I took quite some time to make the actual sketch but this is not so. In fact, I think that I can make such a simple sketch as quickly as a man could with a T-square and triangle, or even more quickly. Of course there is no trouble in typewriting the text. Memory is the thing which may play me false in carrying out my work, but it must be remembered that a blind man can remember what he is doing far more easily than can a man with eyes. Why? Just this, I keep my mind on my work without effort, and all the pretty girls in the city may walk by with ever so short dresses and I still have my attention on my job—and I defy almost any man with eyes to do the same.

I have not as yet been able to devise a way to make circles, but I have a scheme in mind now that will, I think, enable me to make circles and even assemble a drawing from the separate sketches, although I would have to ask for some figures if the drawing amounted to much. If my typewriter had the teeth of the roller spaced evenly with the regular shift made by spacing, I could make far better sketches; and this feature I shall have added to my machine.

Making a Design

A man with eyes making a design gazes at what he has drawn and measures here and there. Few men have absolutely fixed in their minds the exact form of a piece for a machine. Usually, the designer has some idea, of course, but he always fits the work in, and draws what seems to be right, often taking the measurements from the drawing after he has laid it in. Now, a blind man must sit in darkness and get absolutely fixed in his mind just what he is going to draw before he lays down a line; and he must, also, have figured out all the dimensions, or very close to them. If he loses his train of figures and gets confused as to the position of the pencil point, he must start all over again, so it is wise for him to make but one sketch on a sheet.

In Fig. 2 is shown a sketch that is also one intended to be worked from later. In it, I made the long central parallelogram first in the way I have already described; and then, counting down to the position of the upper line of the hub, this line and the corresponding line on the opposite side of the long parallelogram can be easily produced. The right-hand end of the hub was then made, followed by the lower lines of the hub and the final left-hand line. The sketch was quickly produced.

With regard to dictating a drawing the instructions given the draftsman would be as follows for the part shown in Fig. 1: "Draw a fine center line about 2 in. from the upper left-hand end of the paper, beginning about 1½ in. from the edge. About ¼ in. from the left-hand end of this center line cross it with a vertical line extending ¼ in. above and ¼ in. below. From the ends of this line extend two horizontal parallel lines ½ in. to the right. Join the ends of these lines with a vertical line, and extend this line ⅛ in. above and below them.

"From the ends of this vertical line draw two horizontal lines to the right $\frac{1}{16}$ in. Join the ends of these short lines with a vertical line. Lay off on this last vertical line above and below the center line a distance of ⅛ in. From these two points draw two horizontal lines to the right a distance of 1½ in. Close the ends of this parallelogram. Put figures on the various parts." From this, it can be seen that dictating a drawing is not difficult.

Understanding Drawings and Machines

In dictating drawings, the work is to a certain extent easier than drawing them, as by having lines lettered or numbered you can leave one part of a drawing, go to another, and return to the original point, or go on to another with ease—that is, if your memory does not fail you. While this sketching is not difficult, it is quite another matter to understand a description of a blueprint, even if given you by an expert; but with a few forms cut in paper and a lot of patience on the part of the reader I can understand most drawings sent me.

In examining machines, there is no difficulty in understanding any single piece on which you can lay your hands, but the trouble lies in getting the relations between the various parts. If the machine is small enough to reach several of the main members at the same time, then there is no trouble in obtaining a good idea of the entire tool or machine.

Describing Drawings

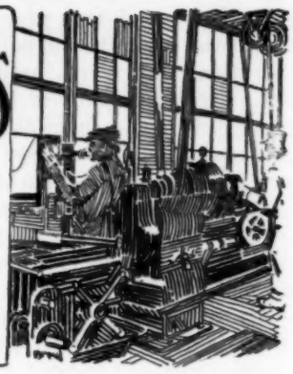
The power to describe a drawing to the blind is almost a gift, but it can be learned, one of the most important points being to give a general description of a piece before giving the details. Thus, my daughter might say to me, "Imagine a piece that looks like a button hook with a hook at each end." That would give me at once a mental picture. Girls have their own ways of giving a definition and usually they make a very clear presentation, especially to the woman mind.

One girl was asked to describe a tangent. She said it was the way a thread leaves a spool of thread when you pull on it. Now, that is certainly a very clear presentation of a tangent and most admirably suited to the mind of a woman. A few pieces of annealed wire can be used to advantage in dictating drawings or in understanding them, but cut-out forms are after all the best means to make a blind man understand a drawing thoroughly.

Concentration, memory and patience are three attributes needed by a blind person to make sketches, or in fact to do anything. To my mind, if these same qualities were more seriously studied and worked by the people who have eyes, they would find that their daily work would soon become easier and would be far better done. One very pleasant thing that the blind learn is that down in the hearts of men there is much kindness, as every one is ready to help a blind person.

MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



XX. What Does It Cost to Sell?

Inaccurate Methods of Determining Selling Costs—Items Included in Selling Expense—Each Sales Problem an Individual One

PROFITS more often fail to materialize because it costs too much to sell than because manufacturing costs are too high. And yet the progressive man who insists on knowing just what it costs him to make a product will commonly lump his selling expense in the crudest way. He maintains clerks to gather the actual amount of labor and material that go into each part—even into each nut and bolt; he uses admirably logical reasoning to arrive at the correct way to allocate the various and intricate elements of overhead; all to the end that he may know just what profit he makes on each line and size of his product. Then he off-handedly throws all selling expense—salesmen's salaries, advertising, shipping, credit department and a dozen other diversified items into one pot and says, "My total selling expense—$100,000—is 5 per cent of my total sales, therefore, I shall say that 5 per cent of the selling price of any item is the cost to sell it."

It *may*, by pure chance, cost him exactly $500 to sell a $1,000 machine against stiff competition to a man who buys only from good entertainers. But it will hardly cost $20 to sell a $400 repair part, which no one else makes, to a man who owns one of his machines. Such contrasting sales conditions as this show plainly the error of considering that the sales price is an accurate measure of the cost of selling. But the man who contemplates this subject is apt to let his thoughts carry him into considering other factors that affect the difficulty—and hence the cost—with which sales are made. They are so diverse and require so much definite knowledge of subjects on which little knowledge exists that he humanly decides to use an easy method, though knowing it is wrong. Hence the percentage of price method of allocating selling expense.

I find that when figures on any phase of business are lumped in an offhand way the method is not only wrong but usually well known to be wrong. Therefore it is not surprising to find that selling expense, which by many concerns is disposed of most easily of all overhead items, is worthy of careful analysis, and is in fact the most intricate of all and the most difficult to handle correctly.

Of course there are exceptions. Some businesses are so fortunately situated that the old-fashioned way of bulking the selling expense will be safe, although by no means accurate. I should say that if a machine shop found its total selling expense to be under 2 per cent of its selling price, and the manufacturing profit of each item to be 20 per cent or more of the selling price, it would be safe to assume that each line was making a profit. In such an event I would hesitate to recommend much detailed study of selling expense, unless I had reason to believe that it would turn up new markets for the product.

One reason, very likely, why more study has not been made of this subject is because the marketing factor in each business is peculiar. The manufacturing problems, whether of costs or of production, are fundamentally alike for all machine shops. That is why a series of articles on machine-shop production and costs is worth reading. The principles are applicable with slight change of method to any shop. But the selling problems are exceedingly different. The data on which a manufacturer of milling machines could apportion his selling expense may have utterly no bearing on that problem for the maker of lathes. In fact, to get figures which will be of appreciable value I believe requires a study of each man's product, market and sales methods. Therefore, in this article all I hope to do is to indicate what factors affect the selling expense and how. I can only start you thinking on the problem in straight lines. Perhaps I can only indicate to you that such a problem—one well worth study—exists in your business.

First, let us list the items that commonly go into the selling expense pot.

(1) Salesmen's salaries and expenses.
(2) Commissions and trade discounts to agents.
(3) Magazine advertising.
(4) Direct mail advertising and catalogs.
(5) Supervision of salesmen—the sales manager and his office staff.
(6) The advertising manager and his office staff.
(7) The clerical cost of entering and billing sales.
(8) The credit and collection department.
(9) Shipping and packing expense.
(10) Share of rent, light, heat, etc.

Now what is it that can be learned from an analysis of these items? First, selling cost by lines of product; second, the relative skill and activity of salesman; third, the relative productiveness of territories; fourth, the relative effectiveness of the kinds of advertising. The selling cost by lines of product is put first because to most men it will seem most important. It is actually one of the last to be determined because it is

so complex. For example, it might be found that the selling cost for one item varies for every territory. For one reason or another the concern's product may be highly thought of in the Detroit district and the selling expense be proportionately low. In the Cleveland territory the same type of user may lean toward a competitor's tool and our manufacturer would find it hard to sell there. That may be due to the fact that the advertising has been concentrated more in the Detroit district. Any number of reasons exist for such a condition. If the prospective buyers are more numerous in one territory than another, a lower cost per call and hence per sale may result.

Selling Price Not Safe Base for Selling Cost

Then there is the undoubted fact that it is not always as easy to sell one item as another. This has been recognized, in fact it probably is the reason why the percentage of selling price methods has been so widely used, for superficially it may seem that it is twice as hard to sell a $10,000 item as it is to sell a $5,000 one. Actually, though, it is easier to sell some buyers the higher priced one, for not a few assume that price is an index of quality. Most anyone will, after a little thought, agree that it is harder to sell a $500 machine to each of twenty buyers than a $10,000 machine to one. So that the gross sales are not a guide.

The realization of these inaccuracies in his methods led one manufacturer to reason that between two of his machines it was harder to sell the one that carried the wider profit margin. That is, if a $10,000 machine gave a profit of $1,000 and another type of machine selling for $5,000 gave the same profit, the same selling expense was charged to each. In some cases that might be a fair assumption, for wide margins of profit attract competition and the presumption is that the competition encountered would be more intense in the high profit lines. But these lines often carry wide profits because of patent monopoly. So we can properly consider the margin of profit as an influence upon selling expense but not as an accurate direct measure.

The fallacy of using either selling price or profit as a measure of the cost of selling comes from considering the selling expense as a lump sum. Actually, as we have seen, it consists of a number of diverse charges incurred for entirely different activities, all of which, however, are for the purpose of selling, or which inevitably result when a sale has been made.

We have already pointed out that the sales dollar is not the logical way to apportion the expense of the direct selling effort, which consists of the salesman's salary and expenses, a share of the sales manager's salary for supervision and the office correspondence with the prospect, for a salesman in one territory may make a $10,000 sale on a single call, while another salesman may reach the $10,000 mark only by virtue of twenty sales of $500 each, which may have resulted from fifty or more calls. Certainly, no one will disagree that it has cost the company more to make the twenty sales than it did the one.

A more nearly accurate method for handling the direct items of selling expense seems to be on the basis of a cost per call. Therefore, as a preliminary to building even approximately correct selling costs, we recommend that fairly minute and accurate reports be required from each salesman. Where this has not already been required, the salesmen may be expected to protest against being required to do clerical work.

It is a common failing of salesmen to look on themselves as supermen of a sort and they often fool themselves into believing that common business practice does not apply to their work, and that sales result from a sort of mysterious magic. The aversion of salesmen to doing even a small amount of simple clerical work is not insuperable. It is being required by some of the largest concerns, and those concerns are invariably found to have most accurate information as to their selling costs, as well as the best selling methods. I know of several concerns in different industries which supply the salesmen with very comprehensive report sheets on which they are required to list not only the calls made each day but the length of time spent with the prospect and the length of time it takes them to go from one prospect's office to another's. In fact, the entire seven hours a day which they are expected to put in is accounted for. In addition, these reports list the reasons why goods were sold or were not sold, as well as the objections put forward by the prospect.

The objection of salesmen to filling out reports of this sort has been successfully overcome; in fact, I very much question whether it is any more of an obstacle than is invariably met with in the shop when proper cost systems are installed. The average mechanic feels much the same way about reporting his time as a salesman does and yet thousands of manufacturing plants are successfully obtaining time reports from their workmen.

I strongly feel that most valuable information can be obtained by requiring salesmen to strip the mystery from their activities and making them tell their employers definitely how they spend their days. With such data as this, the manufacturer can escape the tyranny of the successful salesman. With the information he will get he can put selling more nearly on the scientific basis that he already has achieved in manufacturing.

Cost of Salesmen's Calls

The average calls per day as developed by these records will be an indication of the activity of the salesman. Of course, in dense districts the calls will run much higher than in those districts where prospects are sparse. Consequently, the cost per call will be lower. This leads, naturally, to an accurate study of the market possibilities of the product—information which few manufacturers have. I recall a manufacturer of incandescent lamps who insisted that whenever one of his salesmen saw a factory chimney, he was to call upon the owner of the chimney, for it was assumed that every manufacturing plant was a prospect for electric lamps. As a matter of fact, in those days only about half of the factories used electricity. It should be obvious that a manufacturer of a special machine cannot safely assume that every machine shop is a prospective buyer. Again, it is very difficult to determine in the bulk the total possibilities of a district, because it is hardly possible to predetermine how many machines each buyer can comfortably absorb.

It is my firm belief that until a manufacturer has very much more accurate knowledge as to the absorptive power of his various sales districts than is now the rule, it will be difficult to get even an approximately accurate selling cost by lines and by districts. It is however entirely possible to make surprisingly accurate analyses of markets. The difficulties are much more apparent than real.

In some lines, it should be possible to obtain a record which will be an accurate indication of the closing ability of the salesman. This might take the form of a report showing the number of items sold per call made, although that in some instances might be more nearly a reflection of the absorptive power of the district. When the salesman sells to a single buyer several items at a single call, probably as fair a way to divide the selling expense as could be devised would be to take the salesman's judgment as to the relative difficulty of selling the various items. With a comprehensive report, such as I have already recommended, this would be easily determined.

After data has been gathered for a few months, it should be possible to determine for each territory the normal cost per call and a normal selling cost per item. These figures, naturally, would have to be revised from time to time to meet changes in the cost of traveling. It should be approximately uniform with a district, regardless of the salesmen's salaries, for the presumption is that as a man's salary is increased his selling ability also increases at least in proportion. With such a figure we are in the same position as regards direct selling expense as we are for the overhead expense of the various productive departments; that is, we have a normal figure, subject to revision at fairly long intervals, with which we can compare the actual direct selling cost of each man and thereby have a rather fair line on the relative merits of the salesmen.

When the data have been gathered, it may seem feasible to assign a unit value to various lines in the different territories by means of which the selling cost of all lines in all territories may be brought down to a common basis for purposes of comparison. Here it is well to keep in mind that while it may be more difficult to sell one machine than another, it is seldom more difficult to sell a large machine of a given type than a smaller one. Whether a prospective buyer purchases an eight-inch lathe or a sixteen-inch lathe depends entirely upon the customer's needs and not upon any special effort put forth by the salesman to sell the higher-priced lathe. This is another proof that the application of selling expense on the sales dollar is misleading, for, while the sixteen-inch lathe sells for more than the eight-inch lathe, the same degree of difficulty in selling would probably be encountered with each.

Certain expenses that result after the sale has been made, such as those in the billing department, order department, the accounts receivable, ledger clerks and so on are most accurately charged as so much per item. It admittedly takes as much effort to enter a sale of a $10 repair bill as for a $10,000 machine. Where each item is made to carry the same charge I frequently find that concerns discover that they have been fooling themselves on the profit which they have been making on their repair parts. It is not unusual to find that the clerical expense required to handle repair parts very often eats up the possible profit.

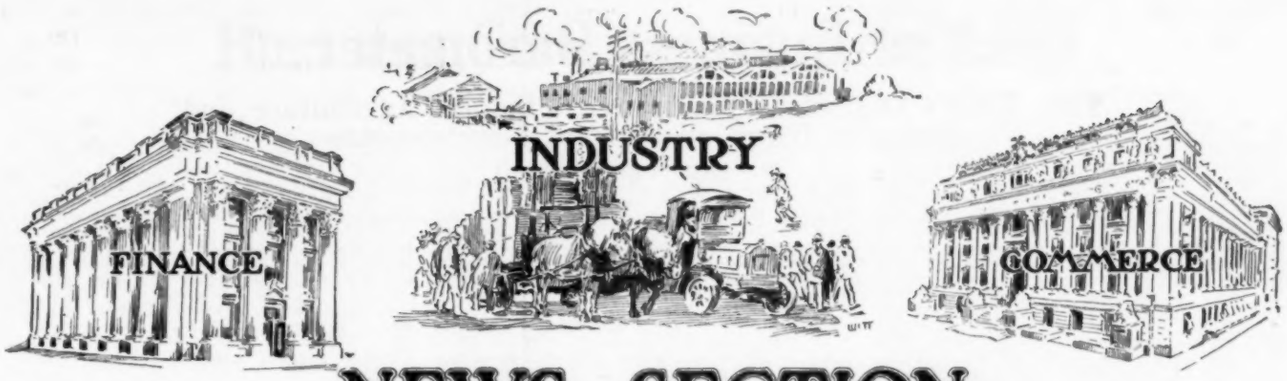
The bad debts of a business can usually properly be charged as a percentage of the total sales. In certain cases they will, however, be found to follow them, less closely than they do the number of accounts handled. The cost of passing on credits, as well as the cost of collecting slow accounts are in like case with the bad debts. As a general rule the volume of sales will dictate how much effort the credit department must put forth.

The shipping and packing expense is, in some businesses, a large one which, if incorrectly allocated, will bring serious errors into the selling expense. The effort involved commonly depends upon the conditions peculiar to the district in which the goods have been sold. If the sale is made to a next-door neighbor, perhaps it will not be necessary to pack the goods at all. If to a point a thousand miles from the factory, fairly strong packing may be required, while if the sale is to a foreign country, more expensive packing still will be needed. I have recommended several times, with good results, that a normal shipping and packing cost be developed for each territory and for each item which is salable in that territory.

Further difficulties arise when an attempt is made to distribute advertising expense. This will very largely depend upon the nature of the advertising. If the magazine advertisement pushes a single line of product, it is of course possible to divide it over the units of that item sold. To be entirely just, however, the amount of the magazine's circulation in the various sales districts should be determined and a normal advertising cost per sale for each district developed. Where more than one magazine is used, the problem is of course complicated, but is still subject to handling on the same basis. When it is possible to key the advertisement in the various magazines so that the relative pulling power of each can be determined, valuable information can be arrived at, but that is oftentimes difficult. When the magazine advertising does not push one line of product over another, but is along institutional lines for the good of the business as a whole, it is still possible to normalize the advertising expense by districts and then divide the cost among the various lines of product in much the same way as I have suggested for handling the direct selling expense by lines. Direct-by-mail advertising may be handled in the same way, although more easily than the magazine advertising because the mailing list will show exactly how many mailings go to each territroy.

When the entire output of a plant is sold through jobbers or commission representatives, the problem of properly allocating selling expense is easy for the manufacturer for he is practically throwing the burden of determining it upon his agent. So far as the manufacturer is concerned in such a case, it is entirely proper to allocate the selling expense as a whole as a percentage of the selling price, for it is common practice to bill the jobber at the list price less the discount. The discount is of course the selling cost so far as the manufacturer is concerned.

As I have said before, little can be done accurately to allocate selling cost unless very definite knowledge is had as to how much business in different lines of product each territory should produce. I have repeatedly seen cases where the so-called "star salesman" has been shifted to another district and shown himself to be a complete failure. Many a selling reputation has been made because the man was fortunate enough to have an exceedingly easy territory, and on the other hand I have no doubt but that many a potentially good salesman has decided that his forte was truck-driving, after a few months' effort to sell in a barren territory. While an accurate knowledge of his markets is seldom possessed by the manufacturer, it is entirely possible for him to get this information. Until he knows what each territory should produce, he is going by guess, a method which he would hardly use in the manufacturing end of his business.



NEWS SECTION

Tool Plants Prepare for Future Demands

By AUGUST H. TUECHTER

President of the National Machine Tool Builders' Association

The machine tool industry is one that must reckon with recurring periods of intense activity and relatively deep inactivity. These conditions are inherent in the nature of the industry. Just at present the depression is relatively greater than ever before. The present period of inactivity gives plenty of time to bring plants up to date, to make all needed repairs, to readjust and refit the very accurate machinery required in the production of machine tools and to study every possibility of improvement. It is along these lines that the machine-tool industry is conducting its affairs at the present time.

The industry is faced with many serious problems as an aftermath of the war. The World War was a war of machinery, and to build the war machinery and to make the war munitions the countries of the world had to depend on the machine-tool builders of the world. In all the warring countries the consequence of this excessive demand was a large increase in the capacity of machine-tool shops. Very few American machine-tool shops were increased at Government expense, their additional capacity being provided with their own funds, as a rule.

The consequences of having this extra large world capacity are very numerous, not the least of which is the almost complete absence of foreign demand. Before the war the foreign market was estimated to absorb about 30 per cent of the output of American machine-tool shops.

It is anticipated that the next period of activity will be one of keen competition in all lines. Manufacturers of every class of goods must look to their costs of production, and this means that they must use the most modern equipment of every kind if they would stay in the running. With plenty of time now for consideration of improvements, the machine-tool industry is preparing itself for that condition, and is urging the manufacturers in other lines to realize this fact so that they, too, will be in position to produce most economically when the demand again returns for their products.

One activity now being undertaken by the association is the serious and comprehensive study of the economic conditions of the industry not only at the present time, but in relation to past cycles, for the last twenty years.

All statistical organizations find the movement of pig iron to be intimately related to general business activity. The machine-tool business is closely correlated to iron, and surveys of the past have developed the typical fact of sales of machine tools dropping off a full year ahead of pig iron. This is most natural, when fundamental conditions are understood, and will be of significance to other industries whose reaction does not come on as fast as in machine tools.

The industry, due to the character of the product, will throw a valuable light on general industrial conditions, at least as a wave of prosperity begins to approach its culmination.

It is our belief that our quota will be significant quite a while in advance of many other distress signals that begin to be apparent to business men making and selling goods for more general consumption. All authorities agree that stabilization of production and demand will be greatly promoted by more careful measuring and weighing of economic forces, and by better adjustment between supply and demand, which is possible only after the real facts are known. Statistical study by different industries affords the only means for developing these facts, on which alone can sound judgment be based. — *Philadelphia Public Ledger.*

Ford Buys Steel Plants

Henry Ford has closed negotiations for the purchase of the Superior Steel Co. and the Union Electric Steel Co., according to strong reports from Pittsburgh financial circles. Both companies have their plants in Carnegie.

Confirmation of the reported purchase could not be had here today in the absence of officials of both companies authorized to speak.

The Superior Steel Co. is one of the largest independent plants in the Pittsburgh district, turning out the finer grades of steel. More than 5,000 men are employed in the two plants when they are operating on full time.

It is rumored that the former Remington Arms Co. plant at Eddystone, Pa., is to be converted into a great fabrication plant for a big automobile concern. Henry Ford is named as the genius back of the deal.

Dormant since the days when the United States Government relinquished the extensive property as a storage plant, the buildings are being cleaned and all machinery is being removed to the empty plant of the former Eddystone Munitions Co. on the river front.

"Adria" Car To Be Built

The Adria Motor Car Corporation has taken over the plant of the Gray Machine Tool Co., at Batavia, N. Y., and will manufacture automobiles. The new product will be known as the "Adria" car, and is said to be designed along unique lines in-so-far as the springs are concerned, the purpose of the special design being to take the load off the driving axle.

The officers of the company are Louis F. Vremsak, of Cleveland, Ohio, president; A. E. Fowler, Buffalo, N. Y., vice president; Willard C. Wheeler, Buffalo, N. Y., secretary. Mr. Vremsak designed the car.

National Structural Society Meets

An important meeting of the National Structural Steel Society, an organization of steel fabricating companies of the Central States, was held at Massillon, Ohio, last week. The business sessions were held in the offices of the National Pressed Steel Co. Fifty delegates of the company representing the largest steel fabricating companies in Ohio, Indiana, Iowa, Illinois, Wisconsin, Minnesota, Nebraska and Missouri attended the meeting.

Karl E. Vogel, of the Omaha Company of Omaha, Neb., presided.

All speakers at the regular meeting emphasized the fact that all of the prices of building and construction materials had dropped to the lowest figure, compared to the price scales of 1914.

Mr. Vogel in his address said that the steel prices were now stabilized. He urged a national co-operation of the efforts of construction steel men.

Other officers of the society are A. L. Denison, of the Rochester Bridge Co., Rochester, Ind., vice-president, and C. J. McIntosh of the Federal Bridge and Structural Co., of Waukaska, Wis., secretary.

Southern Iron Plants Resume Operations

While the number of men still unemployed by the iron, steel and metal trades industries in the Birmingham district is still exceptionally large, more men were at work the early part of August than for several months past, with every indication that the turning point for the better has come at last, and that there will be steady improvement from now on until the metal industries of the district have again attained the condition of normalcy.

The early part of August witnessed the resumption of operations at a number of the larger plants, and the giving of employment to hundreds of workers, most of whom have been idle for several months.

One of the outstanding features of the district's trade development in the past few months has been the extension of commercial relationship by the metal trades industries with the Pacific coast. Iron and steel products of all kinds, mainly the products of the pipe-making shops of the district, have been finding a ready market on the Pacific coast, and the development of this trade is one of the main reasons why the industry has operated in Birmingham and vicinity more extensively all during the period of depression than in other sections of the country. Shipments are made out of Mobile through the Panama Canal.

Recent reductions in the prices of steel products by subsidiaries of the United States Steel Corporation are also expected to materially revive the demand for such of these products as are manufactured in the Birmingham district.

A survey of the iron-making industry in the district shows that there are eight furnaces that could be placed in operation in 24 hours should the revival of business merit it; five that could be gotten in readiness in a week's time; while there are six others that would require from 60 to 90 days. The bins are so well stocked with raw material that no time would be lost on this account.

The policy of buying pig iron for immediate needs only, or the "hand-to-mouth policy" as it is termed, is one of the main things that is holding up the market in this district. Many of the smaller industries are melting iron right along, and, but for this policy, which has been in vogue several months, there should be a heavy demand for pig iron.

Operations have been resumed at the plant of the Bessemer Foundry & Machine Co., Bessemer, Ala., after a brief shutdown. This plant has operated steadily all during the period of industrial depression, though on a curtailed basis.

It is also reported that one of the furnaces of the Republic Iron & Steel Co., at Thomas, Ala., will shortly be placed in blast, and that the Semel-Solvay coke plant, at Ensley, Ala., will resume operations Sept. 1. This will give employment to about 350 men who have been idle for several weeks.

The American Steel & Wire Co. has increased operations at its Fairfield, Ala., plant to six days weekly, while the tie plant of the Tennessee Coal, Iron & Railroad Co., at the same place, will shortly double its present production.

Will Do Some Adding

The Wales Adding Machine Co., Wilkesbarre, Pa., has received an order from the F. W. Woolworth Co., New York, for 800 machines at a cost of more than $200,000, this being the largest single order the company ever received.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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There has been a strange recrudescence of pessimism throughout the country during the week, though there is nothing in the news to warrant it. It may be seasonal, as the present period includes the "dog days," but I am more inclined to go back for an explanation to Woodrow Wilson's contention of seven or eight years ago that business depressions are largely psychological.

During my entire career I have never known a time when the minds of men were more receptive to unfounded rumors of bad news. Last week the postponement by J. P. Morgan of his departure for Europe, though it was caused only by private business matters and by his desire to be in New York while his partner, Henry P. Davison, underwent a critical surgical operation, was seized upon by the rumor mongers and used as a peg on which to hang vague reports of financial trouble in high quarters. These found lodgment in minds predisposed to accept them and they had, I believe, more influence than any actual happenings of the week in precipitating the decline in the securities markets, in halting the advance of cotton, and in keeping down the price of wheat despite the bullish government crop report and the expectation of higher prices which is so general among traders.

Mental unsteadiness is quickly translated into financial unsteadiness in the speculative markets. For this reason I do not believe that the stock market is the reliable business barometer it is generally thought to be, for while its reaction from a long rise generally indicates forthcoming business contraction, its recovery from a long decline is delayed by the pessimism which its own depression engenders so that instead of heralding business recovery it barely keeps pace with it. I indulge in this somewhat theoretical discussion because this, I believe, is the relation which exists between the stock market and business at present.

If the specific developments of the seven days were put into a balance, favorable on one side and unfavorable on the other, they would be separated something like this:

Favorable

Continued evidence of improvement in many industries, including building, iron and steel, silk, cotton and woolen goods, automobiles and tires.

Increased freight car loadings.

Slightly more active wholesale markets and a steady good volume of retail buying.

Firmer prices of a few commodities, especially foodstuffs, which have been too low in relation to other commodities.

The decision of Congress to cut $555,000,000 off the nation's tax bill.

Unfavorable

The passing of the dividend on the American Sugar Refining Co.'s common stock, and other evidences of decreased corporation earnings.

The probable postponement until Congress reconvenes in the autumn of action on the President's plan for funding the railroad's debts to the Government, while paying the Government's debt to them.

That what Bismarck called the "imponderable" factors have outweighed the more concrete and positive evidences of business improvement brought to light during the week is discouraging, but should not shake the faith of those who believe in the ultimate triumph of fact over fiction.

Of the news that has been construed as unfavorable, the statement that the Railway Refunding Bill probably will be postponed exerted the most influence on sentiment. Counted on to make $500,000,000 available for the roads, its introduction in the Senate immediately brought forth sharp criticism from the leaders of the agricultural "bloc." Eugene Meyer, Jr., managing director of the War Finance Corporation, which is charged with the administration of the plan, explained clearly that it is not a loan to the roads, but an extension of Government aid in marketing their securities, and the beneficial results which may be expected to follow its adoption seem so obvious that the opposition ought to be quickly stilled. If the Senators persist in holding out against it, they are likely to work as much harm to their own constituents as to anyone else, for as has been previously pointed out, the railroads are the largest purchasers of commodities in this country and when they resume buying, industry in every section will feel the stimulation.

Railroads Improving

Credits extended to the railroads will never become "frozen." They will be used not for carrying commodities,—but for making purchases, and the $500,000,000 in securities now in the Treasury vaults can be converted into a powerful tonic to business simply by turning them into cash, as the bill proposes, and allowing the roads to use the proceeds. The activity which their buying would engender would be felt throughout industry because it would make possible the payment of other debts, the employment of more labor, and the buying of more raw materials. Five hundred millions, put into circulation, represents the addition of several billions to the business turnover of the country. Mr. Meyer estimates that a million idle men will be reemployed if the plan is adopted.

Despite the setback caused by this postponement, the traffic reports made by the railroads are uniformly good. June returns from all but one of the Class 1 roads show a net operating income of $51,778,000, compared with a deficit of $14,612,000 in June last year. For July, estimates indicate that net earnings will be even higher. Car loadings are steadily increasing.

Tax Reductions Welcome

The decision to effect a reduction estimated at $550,000,000 in the national tax bill is welcome, though it has been long deferred. The details of the proposed revision need not be stated here; they are fully given in the daily press. The proposed reduction in the heavier surtaxes may weaken the market for tax exempt bonds, the further issuance of which is prohibited in a constitutional amendment that has been offered in Congress, but has small chance of ratification even in the distant future. The supply of such securities is meantime undiminished and bonus bills passed or under consideration by state legislatures contemplate the distribution of $375,000,000 among the soldiers. The House is expected to pass the tax revision bill by Saturday, when Congress has decided to adjourn for a month. Most business men are enviously pleased by the decision. The money market is static.

Federal Reserve Stronger

Borrowers in good credit should have no difficulty in obtaining the accommodation they need at reasonable rates if Governor Harding of the Reserve Board and Governor Strong of the New York Bank are right in the optimism they express. The "Golden Flood" continues and the Federal Reserve Banks have increased their gold reserves by $23,000,000 during the week. The reserve ratio stands at 65 per cent, the highest in three years.

In industry the effects of the steady retail consumption which has kept up throughout the period of depression, are being shown in increased activity. New York is crowded with buyers. The demand for textiles is very active and is reflected in the full employment reported by most cotton mills. Silk consumption during July was the largest in a year and a half. Even steel, best barometer among the industries, and coal, the chief laggard, show signs of recovery, for in steel both mill operations and orders are above their figures of a few weeks ago and in coal there is a firmer tone to prices and evidence that some of the largest consumers are preparing to place their contracts. Building during July, according to "Bradstreet's," was 4.2 per cent above the June total. A number of automobile plants report increased production. Southwestern flour mills are operating on the largest scale in a year, a majority of them working twenty-four hours a day, seven days a week. General improvement is reported from the shoe industry.

Foreign Trade Declines

July's foreign trade showed sharp declines from a year ago, but strangely enough the balance of trade in our favor is larger than it was then. Exports totaled $322,000,000, compared with $651,136,478, and imports $178,000,000 against $537,118,871, leaving a balance of $144,000,000, which compares with $114,017,507 for July, 1920.

The market for foreign exchange continues to puzzle the experts and defy the comprehension of the uninitiated. In a few hours last Tuesday sterling advanced ten points on an order to buy five hundred thousand pounds. Bills for other currencies rose sympathetically, but most of the improvement was soon lost. The fact seems to be that as a result of the decline in exports and imports the supply of bills is very much reduced and the market is becoming a very narrow one in which a great many speculators have been caught. Its future is inscrutable and cautious merchants will be careful to buy or sell their exchange before committing themselves on transactions which involve drawing or remitting to Europe.

The news from abroad is more favorable than unfavorable. British July trade showed a further increase in exports and decrease in imports and the textile outlook is so much improved that many Lancashire mills are increasing their output. Both Great Britain and France report reductions in note circulation, but in Germany the total is climbing week by week, and reports of reviving German prosperity should be read with due allowance for inflation. The release of American prisoners from Russia and arrangements to relieve the famine have proceeded without a serious setback.

On this side of the Atlantic the Mexican Congress has at last started consideration of the Constitutional provision nationalizing petroleum deposits, which is the chief bone of contention with the United States. Reports to the Department of Commerce indicate improving business conditions throughout the world.

Balancing these various developments against each other, I see more cause for hopefulness than for depression, provided we do not let fear get the better of courage in acting upon the facts, which indicate steady progress in reconstruction on both sides of the Atlantic.

	End of Last Week	End of Previous Week	Last Year
Bank Clearings (Bradstreet's) in thousands	$51,769,431	$6,548,228	$7,450,751
Business failures	329	319	147
Security prices, N. Y. Stock Exchange			
20 Industrials	66.42	69.50	84.75
20 Railroads	71.30	73.97	73.40
40 Bonds	77.66	78.27	74.14
Commodity Prices			
Wheat, No. 1 spring	$1.66	$1.62	$2.80
Corn, No. 2 yellow	.77	.76½	1.83¾
Beef, good dressed steers	16.25	16.25	23.50
Pork, mess, bbl.	24.50	24.50	33.50
Sugar, refined	0615	06	1710
Coffee, Rio No. 7	06½	07 3/16	09¾
Cotton, middling	1325	1345	3910
Print cloths	04½	04½	13
Wool, domestic average	4173	4021	. . .
Silk, No. 1, Sinshiu	5.75	5.70	5.80
Rubber, crude, plan	.14	.15	31
Hides, pack, No. 1	.14	.14	28
Iron, No. 2, Phila.	19.84	21.35	49.50
Steel billets	30.00	30.00	55.00

Business Conditions in England

BY OUR LONDON CORRESPONDENT

With the settlement, for the time being, of wages of engineering workpeople—they submit to a reduction of 6s. a week in two monthly steps each of 3s.—and the ending of the coal dispute, a hopeful feeling is more common and some day soon material improvement will, it is expected, be noted. But not just yet. For a long spell the weather has been against anything strenuous and the ordinary holiday period is upon us. Prospects of lower prices for coal are not particularly promising, although in Glasgow a decline of 10s. a ton has been reported and in certain districts no alteration has been made; whereas in London the prices have been increased by from 3s. to 5s. a ton, according to the quality; this despite the fact that miners receive a reduced wage and that the industry is being subsidized by the nation to the extent of £10,000,000. It is true that the number of workpeople registered at the employment exchanges as unemployed of late showed a decline, and on July 22 were estimated at about 1,870,000, plus 760,000 on short time. While the improving industrial conditions have helped, on the other hand some of the names have been removed from the lists simply because people have gone out of benefit, having received the full number of doles and donations to which they were entitled. Wages all round tend to a reduction—even the printing trades are now agreeing to this. The official records showed that the June changes affected about 1,060,000 persons, of whom about 14,000 received advances, the net effect being a weekly reduction of £420,000 reckoned on full-time working. These figures, of course, do not include the engineering or mining workpeople referred to above. In fact during the first six months of the year the wage reductions officially recorded apply to 4,300,000 workpeople to the extent on full-time working of £1,770,000, with increases for 350 000 workpeople of £83,000. It is indicated that government employees, agricultural laborers, domestic servants, clerks, shop assistants and salaried persons are excluded from the return. Wages of iron and steel workers in particular have dropped as the result of the sliding-scale system, whereby wages depend on prices obtained, the drop for blast furnace workers being 73 per cent from the 144 per cent by which wages exceeded standard. No further reference need be made to industrial disputes except to mention that according to an estimate, the aggregate duration of these as recorded during the first six months of the current year was about 77,000,000 working days. The cost of living figures remain stationary; that is at an increase of 119 per cent above the figure for July, 1914. Quite possibly no further reduction will be recorded for another month.

Apropos the price of coal and the starting of blast furnaces, according to a reply in Parliament, of the 400 out of 500 blast furnaces in Great Britain which are regarded as effective, not one was in operation at the middle of July.

Meanwhile, despite falling trade, decline in prices, labor disputes and political uncertainty, the leading London banks report their half-year dividends of 14 to 20 per cent. But deposits have shown a (relatively small) decline, acceptances a marked decline, the holdings in bills have definitely increased, and the figures for loans and advances have been reduced.

The overseas trading of Great Britain has naturally declined during the current year, the value of the imports for the first six months being approximately £572,000,000, or rather more than half the value as compared with the corresponding period of last year. The exports for the six months are valued at rather less than £369,000,000, and re-exports at less than £50,000,000, the exports total exceeding £418,000,000 which, like the imports, means something more than half the figures for 1920. June exports were in quantity somewhat more than one-third those of June, 1913, and in value about one-third those of June last year. Imports, at £88,000,000, almost doubled the value of total exports during last month and at that were of only about half the value for June, 1920.

The machine tool exports greatly outvalue the corresponding imports, although the values per ton as a matter of fact have during the last few months tended to become equal. British-made machine tool exports have been fairly steady at about £150 per ton, while imports have fallen to near that figure from £275 per ton, the value four or five months ago. During the current year Great Britain imported 2,243 tons, or not one-third the weight imported during the corresponding period of 1920, while the value, £509,571, is also about one-third the figure for last year during the same period. British exports of machine tools during the current year have been valued at £1,885,151, a 50 per cent increase as compared with 1920, while the weight was 12,977 tons against 9,035 tons.

According to a return compiled for the European edition of this journal by the Board of Trade, taking the items for the six months to the end of June last, the number of drilling machines exported, manufactured in the United Kingdom, was 1,145, valued at £254,347; grinding machines 395, valued at £87,094; lathes 1,681, valued at £610,751; milling machines 446, valued at £130,754; planing and shaping machines 420, valued at £212,001; and presses, punches and shearing machines 329, valued at £136,118. Other machine tools numbered 1,404, the value being £428,971. As to parts, that is chucks and other work holders, the total value of these is given as £25,115.

Turning to the corresponding imports, the items include drilling machines 788, valued at £41,269; grinding machines 211, valued at £29,525; lathes 571, valued at £61 362; milling machines 91, valued at £34,087; planing and shaping machines 161, valued at £16,657; presses, punching and shearing machines 320, valued at £131,345; and other machine tools 901, valued at £179,581. As to parts, that is, chucks and other workholders, the total value of these is given as £15 745.

Casual examination of the figures makes one thing obvious, namely, that as compared with imports the machine tools exported by Great Britain are of the heavier order, excepting in the case of milling machines where imports and exports have about the same average weight. To take the first item, namely, drilling machines, the average machine imported does not very greatly exceed a quarter ton in weight, whereas the average drilling machine exported weighs more than one ton, and so on down the list.

The workpeople of England owe much to the Factory Inspection Department of the Home Office, and the annual report of this section is generally worth study by mechanical engineers, particularly by machine tool builders. The action of the inspection department in enforcing the employment of guards on milling cutters is comparatively recent and the report just issued mentions once again the difficulty experienced in persuading operators always to use them. A suggestion is that the practice might be extended of using an air blast for each machine for the purpose of removing cuttings, etc., thus avoiding the use of the brush, which is dangerous. Special reference also is made to abrasive wheels and the accidents they cause, nearly 30 per cent of which in the principal metal-working district were ascribed to excessive speed. It is urged that mounting and maintenance of grinding machinery should be specially deputed to a person responsible. The strength of the guards provided with these wheels is often criticised and in more than half the breakages investigated the guards were either absent or in this respect inefficient. The size of screws for fastening purposes also is, in some cases described as ridiculously small, and the engineering inspector concerned states that cast iron, unless very substantial, should not be used on account of its inability to withstand shock.

The financial returns of a few engineering companies as recently noted may perhaps be of interest. Armstrong, Whitworth & Co., in their latest report show a net profit on the year's working of £675,179, or apparently about two-thirds the average net profit of the four preceding years. Crompton & Co., Chelmsford, electrical engineers, who are associated with the Armstrong-Whitworth firm, showed a further expansion in profits and maintained their dividend at 10 per cent, the net available balance being £66,291 against £52,878 last year. This company reported new business extremely difficult to get, many inquiries being received but few orders resulting. The General Electric Co. show net profits from all sources of £796,148. Royce, Ltd., Trafford Park, builders of electric cranes, etc., showed a profit on the working of the past year of £14,931, the dividend being 5 per cent free of income tax. Greenwood & Batley, Ld., Leeds, mechanical and electrical engineers, report a net profit for the past year of £23,433. They also pay 5 per cent. A year ago the ordinary shares were doubled by the capitalization of reserves. Taking a shipbuilding firm, Hawthorn & Co., report a profit of £31,339, subject however to certain deductions, and the directors recommend that the balance be carried forward. During the past year apparently the cancellations of orders amounted in value to £261,200, and there has been "an almost complete collapse in the value of ships and a corresponding cessation of shipbuilding orders." Then, W. & T. Avery, Ltd., successors to the James Watt firm at Soho, Birmingham, report a divisible balance after certain provisions, of £95,890, the dividend on the ordinary shares for the year being 15 per cent. W. Asquith (1920), Ltd., the Halifax drilling machine manufacturers, as the result of their first year's working passed the dividend to ordinary shareholders, but paid the dividend on the 8 per cent preference shares.

Reductions in prices continue to be announced both of home and imported automobiles, this applying to cars at both ends of the scale, such as the 24 hp. Sunbeam and the 10 hp. G.W.K. The Buick chassis is reduced from £610 to £545, and the Briscoe car from £595 to £495. The 6-cylinder Nash is reduced by £55 to £595, and he Rolls-Royce chassis from £2,100 to £1,850, the reason given being the reduction of engineering wages and the price of material. It will be noticed that in several instances only the chassis price has been reduced. The cost of bodies is by many held to be one of the handicaps of the industry. The Daimler Co. is making a new 20 hp. 4-cylinder car at £750 for the chassis. This company has recently gone on full time after working two days a fortnight, or thereabouts.

Machine tool firms working full time could be counted on the fingers of one's hands and are chiefly to be found in the Manchester district; Hetherington's may be mentioned and also Spencer's of Hollinwood. The work is of the heavier type, for railway purposes, etc. But orders received in the somewhat distant past rather than really recent demands here fill the shops. Perhaps the largest lathe so far built in this country was recently completed by Shanks at Johnstone, namely, a double-bed lathe of 111 in. to 123 in. centres for turbine work, motor-driven and weighing more than 300 tons. No attempt has of late been made to introduce really new machines, no market existing.

Some reference has ben made above to the motor car industry. Of late several firms usually associated with the heavier cars have turned to machines of the 8 hp. order, and inquiries for this kind of automobile are reported from Japan. Makers of light-weight motor cycles seem to have done better of late, but trade in ordinary cycles has been quiet. It is suggested with some confidence that before long appeals will be made to the public in connection with motor-charabanc companies, and a warning has been issued that figures based on runnings during the present summer will not form a true guide to average conditions; the weather which behaved with so much unkindness to the miners had of course an exactly opposite effect on public motoring. Then too railway facilities were necessarily cut down, whereas the companies are now on the alert and are using all means available to increase traveling facilities. It has been decided that for the running of motor services they must obtain special powers from Parliament.

While talking of travelling a note may be made of the fact that freight charges to India are to be reduced, this arising from German shipping competition. A more general reduction of such charges is suggested and is held to be necessary if trade is really to revive.

Turning again to engineering, the makers of textile machinery in Lancashire seem to take a more hopeful view and orders have been reported from India as well as Japan and France. Most of the firms concerned are at least fairly well placed, but quite a number of orders received or offered involve financial risk which may not readily be accepted.

As to the London iron and steel exchange, buyers of late have generally been less prominent than sellers. The last report suggests that "in manufactured iron and steel the resumption of business is very gradual and although British quotations have in several instances been marked still lower, the continental material still has the advantage as regards price." The cost-of-fuel problem has not been solved and is all-important. Generally speaking, however, it is felt that the worst point has been passed. Although little that is tangible can be produced, still the future is looked forward to hopefully.

Business Conditions in Germany

BY OUR BERLIN CORRESPONDENT

The German Chambers of Commerce have recently filed a cumulative report on the business situation, with special regard to the effects of the sanctions and the reparations payments. Summing up the situation, the report says that while various branches of industry are showing evidence of a revival of business to some extent, which is ascribed to the recent depreciation of the mark, causing buyers to abandon hopes for an expected further reduction of prices, others, especially those strongly dependent on export business, show no improvement.

Foremost among the latter is mentioned the machine building industry. During May and in the first part of June business in this industry picked up, but hopes for a lasting improvement were soon disappointed. In the latter part of June another drop took place, affecting even quarters from which up to that time no complaints had been heard, such as the locomotive and railroad car industry, and several branches of the electrical industry. Even in lines where employment had been insufficient, the depression deepened.

From April to May the proportion of machine building works that had seriously reduced employment rose from 43 per cent to 46 per cent, and has now probably reached 50 per cent. It must be observed that the official standard of what constitutes seriously reduced employment is rather rigorous, allowing under that head only works which greatly curtailed working time and because of various other reasons exhibit manifest signs of distress. Only 21 per cent of all machine building works is reported to be working full time, while the remainder is placed in an intermediate category.

Decrease of Employment in Six Months

The following figures give a comprehensive idea of the decrease of employment in the machine building industry since the middle of November of last year. Starting from the 15th of November, the number of workmen unemployed increased as follows: To the 15th of December by 3 per cent, to the 15th of January by 21 per cent, 15th of February 35 per cent, 15th of March 49 per cent, 15th of April 68 per cent, and 15th of May 75 per cent. An indication of the growing difficulties is also given by the number of bankruptcies, which is increasing from month to month. The total in Germany was in April 267, and in May 284. Although the latter figure remains far behind the pre-war average, it is nearly treble the figure of the corresponding month of the previous year. The comparatively small number of bankruptcies may doubtlessly be ascribed to the fact that war gains are helping to tide over the present times, and that banks are more ready than ever to afford relief. Opinions are frequently heard that a large part of the machine building industry is already under the control of the banks, and that the private ownership of many proud firms has become merely nominal. The frequent transformation of such firms into joint stock companies, as the form of organization most convenient to banks, in spite of the heavy taxation to which such companies are subject, certainly gives support to such opinion. The significant fact that the industrial joint stock companies of the country alone required no less than 10,300,000,000 marks new capital in the first six months of the current year may serve as an indication of what enormous capital the whole German industry is absorbing. As such requirements evidently surpass the financial strength of private individuals, they can be satisfied only by the large money institutions of the country.

Influence of the Banks

Certain peculiar facts which are noticeable in the industry deserve mention in this connection. It can often be observed that works are losing old customers without any visible cause, and in spite of satisfactory quotations. The explanation is that firms dependent on a certain banking institution are directed to fill their demands among themselves regardless of better prices and old established connections. It is a fact that while the public mind has been focused on a number of trusts formed among large industrial works, a grouping has in all secrecy been taking place among the smaller fry, under the leadership of the banks, which now represent the heads of as many industrial trusts. They are diversified as to their nature, and absolutely informal in structure, but they are existent all the same, a fact made manifest by the radical readjustment of business connections noticeable everywhere. As the relief afforded by a strong leaning on banks and the cooperation amongst the members of such unofficial trusts are very valuable under the present stress, banking connections are sought for very eagerly, with result that the process of absorption resulting therefrom is visibly progressing. This fact deserves considerable attention outside of the country, as it explains many of the otherwise puzzling phenomena in German industry.

One of the phenomena is the confidence reflected in private as well as public discussions of industrial affairs, not to speak of the optimistic views held at the stock exchange. The hopes for a settlement of the Upper Silesian problem, the cancellation of the sanctions, and the revival of business in consequence of the settlement of the reparations payments, have so far been disappointed, but the confidence built thereupon has remained. This is peculiar in face of the fact that conditions in Upper Silesia are far from affording any gleam of hope, and the situation in the Rhineland is steadily growing worse. The Upper Silesian works are either still shut down, or if they are kept open it is only to provide employment. Products have to be stocked, business being absolutely at a standstill. Although coal mining is in progress to the extent of about 50 per cent of the previous average, many works have no coal on account of the complete stoppage of transportation. Even after the settlement of the Upper Silesian question it will take months before industry there will again come into swing, especially if, as must be expected, the industrial district is split up between Germany and Poland.

Conditions in the Rhineland Worse

The conditions in the Rhineland are also going from bad to worse because the procedure of making every single shipment across the Rhine barrier subject to license is acting as a severe check. As an illustration of the difficulties encountered both by the population and the commission for the control of traffic, it may be mentioned that from 80 to 100,000 applications for such licenses are received daily by the commission. Its personnel being inadequate to handle such volume of business, licenses are obtained only after considerable delay. This alone is sufficient to turn away business from the occupied territory, especially orders for quick delivery and urgent repair work. Moreover the cost of living in the big towns of the occupied territory has risen considerably. Wages in these towns are now as much as 15 per cent higher than in the adjoining unoccupied districts. It is stated on reliable authority that in May the total value of shipments of the machine building industry in the occupied Rhineland dropped by 30 to 40 per cent below that of April, which had been reported to be one of the worst months experienced. Finished goods are most affected by these conditions, raw and semi-finished products being only slightly less so. As a consequence, curtailment of working time is taking place in nearly all work. In the Düsseldorf district, working hours in April were cut down by 150,000 and in May by 200,000.

Industry in the interior of Germany is, of course, profiting by the crippled state of Upper Silesian industry and by the handicaps placed upon the Rhenish industry, and such improvement on the home market as is noticeable is probably due to these causes. On the other hand, the pressure which is weighing on the export market is still acting with undiminished force, which is perhaps the strongest disappointment the industry has experienced. The uncertainty with regard to the 26 per cent levy on export still prevails. The announcement that the Government is prepared to reimburse exporters was later interpreted as applying to Great Britain only, while a settlement of this important question with regard to the other Entente countries is still in suspense. The consequence is that business with Great Britain only is exhibiting signs of revival. A slight improvement is noticeable with regard to the Scandinavian countries, mainly Sweden, but it can be observed that European countries, especially the immediate neighbors of Germany, exhibit great reserve in buying.

Situation in the Machinery Industry

In the various branches of the machine building industry the situation is briefly the following: The best employed lines are those works manufacturing railroad materials, especially locomotives and railroad cars. But as has already been mentioned, business in these lines has lost some of its former briskness. The locomotive shops have a considerable number of foreign orders on hand, mostly for Spain and South America, and in a lesser degree for Russia. They have, however, been disappointed with regard to home orders, which have lately been issued for the requirements of the current year. They call for only 750 engines. As the large works like Borsig and Henschel alone are capable of turning out 40 to 50 engines per month, and the number of engines ordered by the German state railroads had to be distributed over some twenty factories, the domestic requirements are entirely insufficient to keep the locomotive industry in bread and butter. It can, therefore, be expected that this industry will soon appear as a keen competitor on foreign markets. The same may be said of the railroad car industry, which up to now has been fully employed, mostly on home orders. While the works in the north of Germany are reported to have sufficient work on hand, those in south and central Germany are raising complaints of insufficient employment.

The electrical industry, which in the low tension current departments enjoyed brisk business, is now also affected by the depression. An exception is apparent in the case of small motors, large numbers of which have been ordered by farmers and the makers of farming machinery. The demand for larger outfits has appreciably diminished.

Automobile and Other Industries

The automobile industry, which had hoped to profit by further depreciation of German currency, seems balked in its expectations. Austrian works, like the Austrian Daimler Company and the Austrian Arms and Ammunition Company (the latter manufacturing a good car built on American lines) have received large foreign orders, especially from Great Britain. But foreign buyers seem to have avoided German industry and only the foremost makes have orders on hand for several months ahead. The majority of the approximately sixty German automobile works have dropped into what is practically a hand to mouth existence.

In all other branches, including agricultural machinery and machine tools, business can be said to be still on the down grade. So far as single works enjoy good employment, it can be observed that this is due to their manufacturing types of special construction, or of such high quality as to lift them out of the general run. In fact, the 21 per cent of workers reported to be fairly well employed is in that class of factories. The present conditions and the gloomy outlook for the near future are clearly demonstrated by the business situation of the machine tool industry, which generally serves as an indicator of good or bad weather.

The slight revival of business mentioned in the last Berlin report in these columns was of no long duration. It was followed by a further decline. Even inquiries, which previously had maintained at least a certain semblance of business and a hope for better times, have diminished. The only demand noticeable is for specialties. The market for standard machines is declared to be absolutely dead. In certain classes of this industry the depression is taking proportions which are indeed serious. Your correspondent has met manufacturers who declare that they have not turned out a single tool in months. Most affected by the slump is the Chemnitz district, the home of the standard machine tool. With the exception of the works of Reineker, Pfauter, and the like, which are making special tools of high repuation, the works in the district seem to be in a state of neither being able to live nor die.

As a consequence of such conditions the demoralization with regard to price conventions and co-operation of industrial associations, already mentioned in previous reports, is progressing further. An unbroken front with regard to export business is still preserved in a number of branches. This is due to the influence of the industrial associations. The single manufacturer urgently desires decontrol of exports, in order to find an outlet for his product. The immediate result of decontrol would, of course, be a severe cutting of prices, as is proved by the case of lines which have lately been freed from export control. That price cutting has so far not taken larger dimensions because export prices have already been reduced to a very small

margin above domestic prices, a margin which in most cases represents nothing more than the export tax levied by the German government. Foreign buyers in Germany can now have machines on quick delivery, at a price leaving the manufacturer a very small profit only, and at one of the most favorable rates of exchange in experience. That even such circumstances fail to elicit business in foreign markets, as is the case now, is considered one of the most disquieting features of the present day situation.

Germany Hopes to Sell France Reconstruction Material

Much is hoped, therefore, from the negotiations in progress between Germany and France with regard to the supply of reconstruction material. It will be remembered that Germany some time ago made France offers for such supply, totaling about 11 billion paper marks, or 800,000,000 gold marks. The allied countries have availed themselves of these offers to a very small extent. The orders which have actually materialized therefrom are rather small. The agricultural machinery industry and the locomobile works, for instance, received orders for 110 million gold marks. Only 12.6 million marks worth of machine tools, electrical machinery and small tools was ordered. Of these orders, only 128,000 marks worth has been shipped. Makers of railroad materials received orders amounting to 19,000,000 marks. These orders were placed through the government offices. By far larger quantities have, however, been ordered in direct communication between purchaser and maker.

The sanctions, with the uncertainty they created with regard to the export tax, have put a stop to this business. For this reason the outcome of the negotiations between the German reparations minister Rathenau, who it will be remembered is also the president of the AEG (General Electric Company) and his French colleague, is awaited with keen anxiety. Rathenau's chief endeavor is, of course, to change the reparations from payments in specie to payments in products. If, as seems quite likely at present, he will succeed in carrying his point that such supply is the only way for Germany to honestly carry out her reparation duties, a large amount of business will be forthcoming which will benefit all branches of industry. It is probably very fortunate that Germany has found in Rathenau a man keenly alive to the practical side of the problem. As past experience shows, the purchaser will not be denied direct contact with the dealer, and will go a long way to avoid official intermediaries. The problem for Germany to export goods instead of money can therefore not be regarded as solved, even if government heads agree, unless a satisfactory sort of clearing house is established, which probably presents the knottiest part of the whole question. If this task is delegated to German organizers recruited from officialdom, they may be trusted to erect a strong barrier between want and supply, which will frustrate the best intentions of the governments concerned and also the hopes of the industry built upon them.

The German Labor and Wage Situation

The industries of Germany, from all accounts are in better condition than those of any other country in Europe, although there is a tendency in all other countries to overstate the situation and the advantage of Germany's low exchange rate. All of the industries are not prosperous and reports the works are running ten and twelve hours per day are incorrect. More than eight hours' work per day is forbidden by law, one of the reasons for it being to assure a distribution of work to all, which would not be an argument if there was plenty of work.

A well-informed writer in a recent number of the London *Economist* discusses at some length the labor situation in Germany and the tendency of wages. He throws light upon a subject very generally misunderstood. He says, in part:

"The underlying assumption that throughout a long term of years German cheapness, which is a vagary of the incalculable foreign exchanges, will prevail, is not justified by observation, any more than it is by economic theory. German gold prices, as I showed last week, have been overtaking the higher gold prices of the gold exchange countries German nominal prices (commodities) are today almost exactly the same as they were in February, 1920, when the dollar exchange touched 104 marks; the dollar is today 69; and in the meantime the gold prices of the United States have fallen to about half their maximum. The belief that the German workman works for long hours is mistaken. He works for eight hours, in coal mines for seven hours; if a bill already submitted is passed he will work in all mines for seven hours, and last year in the Ruhr mines a general strike was threatened in favor of six hours. The assumption that German workmen work, and will work, for extremely low wages is based on confusion between nominal wages, gold wages, and real wages. German gold wages are very low. The German real wage, the only wage that comes into account in considering working-class "content," and "apparent acquiescence," is not low. It is considerably higher than before the war. The cost of living index (Statistical Bureau's) is 880; the Wages Index (Frankfurter *Zeitung's*) is 1,132; in other words, real wages are 30 per cent higher than before the war. Further, German workmen show the same persistency as British or American workmen in pushing up or keeping up wages. Between January, 1920, and April, 1921, the cost of living in Germany rose 50 per cent, whereas nominal wages, always as the result of agitation, rose 120 per cent, so that the present movement is altogether for a higher real wage. Naturally, in foreign trade competition it is not real wages, or nominal wages, but gold wages that count. But the German nominal cost of living is kept at its present level only by price-restriction and food-subsidizing. This is no permanent system; a great part of it has been abolished, and the rest is to be abolished; and should the cost of living in consequence rise there is no doubt that workmen will demand higher wages, as they did when cost of living was rising in 1920; and this, given a stable exchange, will mean a rise in gold wages. A new vagary of the exchanges (and the mark exchange in three months of 1920 rose 200 per cent) may upset all these calculations, so that calculations for 40 years ahead based on a present exchange level are not convincing. In fact, it is not easy to see how the reparations payments can be made unless the German workman does consent to work long hours for low wages; the difficulty is that German workmen show no consciousness of the necessity. The practicability of the plan to compel Germany to pay in certain kinds of goods which do not compete with British industry is doubtful. The coal output of Germany cannot be rapidly increased; for two years the attempts made have for labor and technical reasons, failed; potash is not being bought by America, the chief former customer, because it is already too dear, and France, the chief reparations claimant, is herself exporting potash; and the sugar abundance which Mr. McKenna points to does not exist.

The finances of the German Government are still in bad shape, with the volume of currency increasing, but too much emphasis should not be placed upon this. There is reason to believe that the situation is not so far out of hand as may appear, and that by doing away with food subsidies, placing the railroads on a self-supporting basis and other reforms the siuation may be rapidly improved.

The crops in Germany this year are very good, which will permit a reduction in food importations.—*Nat. City Bank (N. Y.)*

The Economic Situation in Russia

The following is a summary of the economic situation in Russia, compiled by the Department of Commerce from various reliable sources.

The most acute famine area covers the Volga Valley from the Caspian Sea northward. The drought in this area would not be of such fatal character but for the general decadence of agriculture in reduction of surplus in other regions and in the decay of transportation, rendering most difficult the movement of such local surpluses as do still exist. Examples of reports from the drought area show the Province of Samara sowing this spring only 58 per cent of the acreage cultivated last year. In the Province of Kazan, 95,000 acres usually cultivated were not sown at all. To the west of the Volga Valley less than 50 per cent of the arable territory in the Province of Orel was sown, and in the Province of Tula, only 20 to 35 per cent of the necessary seed for sowing was available.

Overriding such local situations there has been a steady decline in agricultural production ever since the revolution owing to the lack of incentive to farmers to provide more than for their own needs. The urban population has produced little goods to offer in exchange and the currency depreciation through the increase of currency issues to over 1,000 billions of roubles has rendered their accumulation no attraction. From these causes Russia, before even last year's harvest, had declined from a state producing from six to ten million tons of food for export, to a condition where there was such an insufficient supply of food for the cities that the urban population has been reduced by about one-half.

There has been such deterioration of transportation that there is doubt as to ability to move the local surpluses that do exist in the richer grain producing provinces in Siberia and the south to those areas which normally depend upon them. The Volga region is even less accessible to transport of relief from abroad through the seaports than from Siberia. The north Russian shortage is due not so much to local famine as to general agricultural decadence and especially to breakdown in transport from the south and east. This area is nearer seaboard and can be relieved to some extent from the outside.

Railways

Out of a total of 19,106 locomotives in good condition before the war there are at present from 5,500 to 7,650 reported in working order by different authorities, or a decrease of motive power by 60 to 75 per cent. Of that number approximately 1,000 are idle owing to lack of fuel. Serviceable cars are reported at from 150,000 to 286,000, or a decrease of from 48 to 70 per cent of the pre-war number.

The roadbeds are reported in very bad condition and if large repairs are not made in the next few months, considerable sections will have to be closed to traffic. Accordig to the latest estimate at least 25,000,000 ties must be replaced and the present program calls for only 5,000,000 replacements. A considerable mileage of branch lines has been removed and used for repair material.

The fuel situation is very serious. Cessation in production of coal by 80 per cent and the deterioration of the mines has forced the railways to depend much more upon wood. Such wood must come from the forest of northern Russia and the haul is too long for supply to southern Russian railways. An effort has been made to change the locomotives on the southern railways into oil burners, but the gradual decline of oil production has limited this transformation.

Industrial Conditions

The following table shows the industrial production during the year 1920 in percentages of pre-war output:

	Per cent
Pig iron	2
Copper ore	0.6
Iron ore	2
Manganese ore	2.6
Salt	15
Rubber industry	5
Watch industry	15
Paper industry	20
Sugar industry	5
Printing	15
Production of coal	20
Cotton spindles operating	3
Woolen cloth	4

It is thus estimated that industry in general has decreased over 90 per cent.

Foreign Commerce

Under the impulse given by shipment of the former bank reserves of gold there has been some stimulation to imports. The total imports for six weeks, April 1 to May 15, are given as 60,000 tons or less than 4 per cent of pre-war averages for the same period. Exports, aside from pine logs, were reported as 1,700 tons for April or about one-twentieth of 1 per cent of the same period pre-war. Recent reports as to instructions given to foreign agents of the Russian Government indicate the practical exhaustion of gold and consequent reduction of foreign purchases.

Trade Conditions in Shanghai

The trade of Shanghai is steadily improving, though still far from what it should be, according to a statement by Consul General E. S. Cunningham. Both financially and commercially Shanghai is much stronger than at this time last year, and "there is no wild gambling in exchange and shares to bring a calamitous aftermath later on in the year." Stocks are being reduced slowly, prices are generally in the ascendancy, and dealers are more inclined to buy than they have been for some time past; there has been an improvement in the export market, with some demand, and industrially there are many signs of genuine activity and progress.

Washington Notes

By Paul Wooton
(Washington Correspondent)

If the metal mining industry in the United States were to bring its underground mechanical equipment up to the same standard of development that has been achieved in mills, smelters and other surface equipment, it would be a long step toward overcoming the industry's present state of stagnation. This is the opinion of H. Foster Bain, the Director of the United States Bureau of Mines. He points out that an analysis of the costs in nearly any mine will show a disproportionate amount of costs in underground operations. The largest single item of cost underground is shoveling. Mechanical shoveling long since reached a high state of development. Its application to metal mines is entirely feasible, as has been demonstrated in actual practice. This is only one example of the unusual slowness on the part of metal mine operators to increase efficiency by improving their mechanical equipment. The mining industry more than any other is feeling the pinch of the shortage of unskilled labor. The immigration policy of the country has been in process of development for many years. The trend toward the exclusion of the rough labor element has been no secret. Other industries have met the situation by resorting to mechanical means of replacing common labor. If the mining industry is to operate on anything like a normal scale during the next few years it is believed that mechanical equipment must be used to a much greater extent underground than ever before has been the case.

Opposes American Valuation

The Bullard Machine Tool Co. is of the opinion that foreign valuation is preferable to any scheme for American valuation. A memorandum from that company declaring its opposition to American valuation has been filed with the Finance Committee of the Senate.

The tariff bill passed by the House contains full provision for the valuation of all imports at the prevailing prices in the United States. It is known that the Senate committee is almost equally divided on the American valuation proposal. A decision in the matter is to be made by the Commission, however, before opening hearings on other provisions of the House bill.

Artillery Carriages

The Chief of Ordnance has authorized the publication of the following:

Under the auspices of the Army ordnance department, there have just been completed by the Holt Manufacturing Company at Stockton, Calif., two new types of self-propelled gun carriages of the caterpillar design. One of them mounts interchangeably either the 75 m. m. gun or 105 m. m. howitzer of the models of 1920, and the other, and larger type mounts interchangeably either the 155 m. m. gun or 8-inch howitzer of the models of 1920. Two of each type of carriage have been produced, and they are en route to Aberdeen Proving Ground, Md., for final proof firings and maneuvering tests. The smaller carriage for the 75 m. m. gun and 105 m. m. howitzer has a total weight of 13,000 pounds and a maximum speed of 30 miles an hour. This is the highest speed yet obtained by a caterpillar vehicle. It is driven by a 75 horsepower 8-cylinder engine. The larger carriage for the 155 m. m. gun and 8-inch howitzer weighs about 22 tons with the piece mounted thereon. It will have a maximum speed of 15 miles an hour on good roads, and it is equipped with a 250 hp. six-cylinder engine that provides sufficient power to enable the carriage to negotiate difficult grades in cross-country work. The five-degree traverse on the carriage either side of center is supplemented by easily operated traversing cranks that permit all-around fire to be delivered. The axis of the gun is only 64 in. above ground, allowing the cannoneers while loading and laying the gun to stand on the ground and thus rendering it unnecessary to provide a raised loading platform. Outriggers on the rear of the carriage to insure stability while firing may be dropped quickly into place upon reaching the firing point.

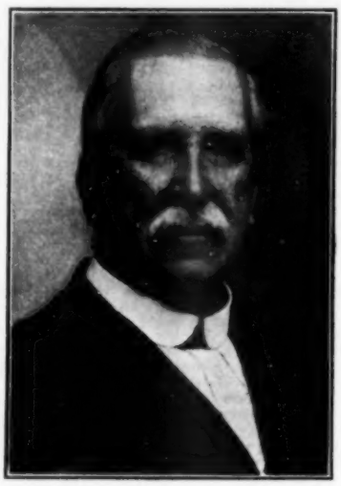
Coal Shortage Due

A serious coal shortage, similar to that of a year ago, which brought about speculation and exorbitant prices, faces the country during the coming winter, according to the Geological Survey's figures.

Coal buying seems to be for current use only, consumers apparently holding off in expectation of lower prices. The summer season is passing without the usual accumulations for winter, and warnings are becoming urgent that a coal famine may result later, particularly if there should be a revival of industry. Prices are demoralized, but still high as compared with pre-war prices.—*Nat. City Bank (N. Y.)*

Death of Henry F. Colvin

Henry F. Colvin was born July 6 1838, in Plainfield, Conn., but moved at an early age to Scott, Pa., just north of Scranton. His first work was at gunsmithing, with his father, Davis Colvin, using the primitive tools and methods of that day. In 1856 he began firing a wood-burning locomotive on the Delaware, Lackawanna & Western Railroad, and became an engineer in 1859, at the age of twenty-one. During



HENRY F. COLVIN

this time coal was introduced as a locomotive fuel, and he ran the old "Anthracite" much of the time during the Civil War.

The jar and the strain of twenty-four-hour service, as was common in those days, proved too much for him, and he next ran locomotives on smaller railroads having shorter runs, finally going to the Rhode Island Locomotive Works, in Providence, R. I., as a machinist. His knowledge of locomotive running and coal burning was responsible for his soon leaving the shop to go out on the road to erect new locomotives and to see that they performed satisfactorily in service. In this way he became well acquainted with railroading conditions in various parts of the country and made many lasting friendships.

Leaving locomotive work in about 1876, he became identified with the Rue Manufacturing Company of Philadelphia, Pa., makers of the Rue injectors. After traveling for this concern for about two years he moved to Philadelphia in 1878, and finally became general manager of the company, holding this position until his retirement from active business about twelve years ago. While there he patented several improvements in injectors and steam jet apparatus.

Soon after going to Philadelphia he joined the Franklin Institute, and was an active member until his death. He was a member of the Committee of Science and the Arts for twenty-nine years. Being a keen observer of mechanical details and possessing a remarkable memory, he became an authority on locomotive history and development, and was consulted by many in this connection.

Always deeply interested in locomotives and railroading, he followed the design of compounds very closely, and patented both the two-cylinder cross-compound and the tandem-compound built by the Pittsburgh Locomotive Works.

Among his intimate associates were M. N. Forney, John A. Hill, Angus Sinclair, D. A. Wightman, J. Snowden Bell and many others well known in mechanical circles, and his advice and experience were much sought by authors and others. This was always freely given, his great desire being to see that history of this sort was correctly written. His recollection of details was almost uncanny in its accuracy, as was frequently proved to the discomfort of those who thought differently, and his co-operation and helpful suggestions will be missed in many quarters.

He leaves a widow and a son by a former marriage, Fred H. Colvin, editor of the *American Machinist*.

Improvement in Employment Situation

In analyzing the employment situation during July, the United States Employment Service reports improvement in the vehicle industry, in railroad repair shops, in the leather industry, in textiles, in lumber manufacture, tobacco manufacture, and in the paper and printing industries, with the broad conclusion that indications everywhere point to the certainty of an approaching business revival.

Positive Lock-Bolt Co. Acquires Safety Nut & Bolt Co.

The Positive Lock-Bolt Co., Cleveland, organized with a capitalization of $250,000, has acquired the plant and assets of the Safety Nut & Bolt Co., at 6528 Carnegie Avenue, Cleveland. W. H. Burke, general manager of the new company, says that the factory will be completed and equipped within the next 90 days to manufacture the lock bolt and other specialties. Officers of the company are: President, C. C. Murphy; vice president, J. N. Leatherman; secretary, M. D. Neff; treasurer, Edna B. Craft; directors, H. J. Jollay and W. F. Koehm.

New President and Officers of the W. A. Jones Foundry & Machine Co.

A meeting was held July 29, at the Chicago offices of this company to elect a new president to succeed Mr. W. A. Jones, who died recently. Mr. T. A. Jones was appointed and the following officers were also elected: W. G. Jones, Vice President and Treasurer; J. A. Sizer, Secretary; G. W. Page, Assistant Secretary.

The general policy of the company is in no way altered by these changes, and Mr. W. G. Jones continues as general manager, in addition to holding his new position as vice president and treasurer.

Mr. T. A. Jones, the new president, has been associated with the company for many years as its secretary and treasurer.

Obituary

Ludwig Held, 81 years old, who has been connected with the Sinker-Davis Company, Indianapolis, manufacturers of machine tools for 31 years, died recently at his home.

Edward W. Clark, president of the Clark-Turner Piston Company of Los Angeles, Calif., died at his home in that city on July 30th. He was born in Rochester, Minn., in 1861. Before going west 21 years ago he was a mechanical and constructing engineer. The company which bears his name specializes in small pistons and has established a market in many parts of the world. Mr. Clark is survived by his wife, two daughters and three sons.

Julius H. Preston, a director of the Textile-Finishing Machinery Co., Providence, R. I., died unexpectedly at his home in that city July 19, aged 54 years. He was one of the founders of the United Lace & Braid Co., Auburn, R. I., and was also president of the Anchor Oil Co., Bakersfield, Cal.

William R. Whyte, superintendent of the Hartford Tube Products Co., Hartford, Conn., died at his home in that city July 16, aged 44 years. He was a native of London and had lived in Hartford for 20 years.

William P. Siebert, Jr., son of W. P. Siebert, of the Carnegie Steel Co., died at Roswell, N. M., July 29. At the time of his death, Mr. Siebert was eastern sales manager of the Weirton Steel Co., Weirton, W. Va., with offices at 30 Church Street, New York, and before locating in New York had been with the same company at its Clarksburg and Weirton plants.

Jonathan E. Porter, founder of the Porter Machine Works, Hatfield, Mass., and inventor of the well-known Porter lathe, died at his summer home in Crescent Beach, Conn., July 21, aged 72 years. A native of Hatfield, his first business venture was with the Prescott Piston Co., with which he remained for seven years. He then bought the foundry of H. Porter, which was burned, and in 1884 he built a factory for the building of lathes, which has grown to the present size of the Porter Machine Works.

Business Items

The Seaboard Iron & Steel Co., with offices at Baltimore, Ohio, has let contracts for a number of work buildings.

The Société Anonyme des Usines Giulini, Basel, Switzerland, manufacturer of Virgin aluminum ingots, notched bars, bar plates, and sheets, has appointed C. W. Leavitt & Co., New York, N. Y., its sole selling agents for the United States and Canada.

The Illinois Car & Equipment Co., Hammond, Ind., reopened Aug. 1 with employment for about 8,000 men. The concern has a large order for railroad repair work in the East.

The Westinghouse Electric and Manufacturing Company has received through a foreign subsidiary an order for $1,200,000 worth of apparatus for the Midi Railway of France, a large portion of which will be made at the plant at Worthessington, Pa. The order includes transformers, condensers, arresters and other substation equipment.

Commercial Attaché Carlton Jackson reports that $250,000 worth of sugar-mill machinery has been sold to an estate in the State of Puebla, Mexico, by an American firm. Mr. Jackson states that other purchases have been made by other mills, some from England, and that there is considerable activity on the part of sugar producers in rehabilitating their plants throughout the country.

According to D. J. Mullen, superintendent of motive power, the Beech Grove shops of the Big Four R.R., located at Indianapolis, Ind., have increased the number of men employed in practically every department. The locomotive shops are being operated at 72 per cent capacity, with about 900 men on the pay roll. Wage reductions amounting to about 10 per cent have been made since July 1.

The Toho Industrial Co., exporter, importer and manufacturer, has established a sales office in the Japan-America Trust Co. Bldg. (Nichibei Shintaku Bldg.), 18 Kitamaki-Cho, Kyobashiku, Tokyo, Japan. This building is situated in the center of the business district of Tokyo. Several experienced salesmen have been added to the staff.

The Oxford Steel Products Company, Boston, Mass., has been organized and incorporated with a capital stock of $300,000 to deal in steel and iron products. The president is Clarence E. Dodge, of Boston, Mass., and Maurice T. Viall, of Cranston, R. I., is treasurer.

Officials of the Berger Division of the United States Steel Corporation, Canton, Ohio, have been informed that E. A. Watson, of Cincinnati, a salesman for their division has been elected first vice-president of the auxiliary of the Ohio Sheet Metal Contractors' Association. The auxiliary was formed by the jobbers and salesmen who attended the convention last week.

Announcement was made last week of the opening of the Central Welding Co.'s plant of Canton, Ohio. The new plant will be located at 1002 Twelfth St., N. E. Glen E. Wilson is president and general manager of the new firm. He was formerly a salesman with the Oxweld Acetylene Co., of Chicago, Ill.

The Oxweld Acetylene Co., of Newark, N. J., manufacture of Oxweld welding and cutting equipment, announces the removal of the offices of its foreign sales department from Newark to No. 30 East 42nd St., New York City. Separate departments for sales, engineering, advertising, shipping and accounting have been established.

It is reported that machinery manufacturers in Indianapolis are planning to take a large part in the Indianapolis Industrial Exposition, to be held October 10 to 15 at the Indiana State Fair Grounds under the auspices of the Indianapolis Chamber of Commerce. The convention of the National Purchasing Agents Association to be held the same week in Indianapolis is adding an interest to the Exposition.

The Resilient Safewheel Co., Inc., Pittsburgh, Pa., has purchased the plant of the American Axe and Tool Works, at Glassport, Pa., and will manufacture automobile wheels. Officers of the company say that they have orders for 30,000 wheels. The new factory will be fitted up as soon as possible and will be in operation before Jan. 1.

The Worcester Automatic Sprinkler Co., of Worcester, Mass., has recently been incorporated to manufacture and install sprinkler systems for industrial plants, buildings, etc. Frank P. Ryan is president, Silas H. Lord, Worcester, treasurer.

The American Tube and Stamping Co., of Bridgeport, Conn., manufacturer of hot and cold rolled steel, etc., is planning the construction of large additions to its West End plant in Bridgeport during the coming year. The plant now occupied by the Porcupine Co., boilers and structural steel manufacturer, will be taken over by the company shortly also, which will be quite an expansion in itself.

Capitalized at $300,000, the Marks Steel Supply Co., Cleveland, Ohio, recently was incorporated and has taken over the business of the Leo. H. Marks Steel Supply Co., of that city. Officers of the new company are: President and general manager, Leo H. Marks; vice-president, Mort Marks; secretary and counsel, Reuben Shapiro. These men with the following compose the board of directors: J. H. L. Janson, J. A. Markley, H. T. Bernstein and Albert Singer.

After having been in partnership for 45 years, Ashland's (Ohio) largest industry, the pump and hay tool works of F. E. Myers & Bros. has become a corporation with an authorized capital stock of $6,000,000. The president is F. E. Myers; first vice-president, Philip A. Myers; second vice-president, John C. Myers; third vice-president, Guy C. Myers; secretary and treasurer, F. B. Kelloh.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A commercial agent in England desires to secure the representation of firms for the sale of wire rope, cables, electrical fittings, machine tools, engineers' goods (not technical), and printing machines. Quotations should be given c.i.f. London or f.o.b. New York. Reference No. 35308.

A mercantile company in Scotland desires to purchase paper-box machinery for making 8-ounce and 1-pound tea bags, lined and unlined. Quotations should be given f.o.b. port of shipment. Cash to be paid. Reference No. 35309.

A firm of merchants and engineers in England desires to purchase galvanized corrugated iron in 22, 24 and 26 gage, preferably 24 gage, in 6 to 10 foot lengths, by the usual width of 2 feet 3 inches. Greater widths will be acceptable. Quotations should be given c.i.f. English ports. Payment: Cash and bank guaranties in advance. Samples will be acceptable. Reference No. 35311.

A merchant in France desires to purchase and secure an agency for the sale of all supplies for automobile construction, builders' hardware, building materials, carpenters' and locksmiths' materials, etc. Quotations should be given c.i.f. Marseilles or Lyon. Reference No. 35285.

A mercantile company in India desires to secure the representation of manufacturers for the sale of mill, gin, and railway supplies, sanitary wares, glazed and unglazed tiles for flooring, broken tiles and electrical goods. Reference No. 35286.

An importer in China desires to be placed in communication with exporters of copper and lead. No. 35287.

A company of Spanish importers established in Barcelona wishes to enter into business relations with manufacturers and exporters desiring to extend their trade to that country. Reference No. 35257.

A manufacturer in Mexico desires to purchase woodworking machinery for making hubs, spokes and complete wagon and coach wheels. Quotations should be given f.o.b. El Paso, Tex. Cash to be paid in United States currency. Catalogues and prices requested. Reference No. 35259.

A merchant in Ireland wishes to secure an agency for the sale of motor cars, motor accessories, aluminum ware and wire. Quotations should be given c.i.f. Belfast or Dublin. Reference No. 35263.

A commercial representative from South Africa, who is in the United States for a short time, desires to secure an agency for the sale of tractors and automobiles. Reference No. 35265.

A mercantile firm in Italy desires to secure an agency for the sale of automobiles and accessories, copper sulphate, agricultural machinery, tractors, surgical instruments, boots and shoes, lubricating oils and mineral oils. Reference No. 35271.

A merchant in Ireland desires to secure an agency for the sale of agricultural machinery, household aluminum ware, apiary supplies, building materials, clocks, safes, saws, stoves, lamps, sporting goods, toys, vacuum cleaners and wire. Reference No. 35272.

A mercantile firm in Ireland desires to secure an agency for the sale of electrical good, miscellaneous machinery, saws, toys, and woodworking machinery. Reference No. 35275.

A firm in Ceylon desires to have manufactured in the United States, rubber-tapping knives, like samples which will be furnished. Quotations should be given c.i.f Ceylon port. Terms: Payment to be made against documents through bank. Reference No. 35279.

A mining company in Chile desires to secure catalogues illustrating all manner of mining machinery, oil engines, pumps, rolling stock for railways and mines locomotives, electrical machinery and appliances, tools, lubricating oils, packings, wire ropes, steels and irons and explosives. These supplies are required for furnishing a railway, fleets of steamers, tugs and launches, workshops, foundries, power stations, farms, coal fields, etc. Quotations should be given c.i.f. Chilean port. Reference No. 35282.

A technical commission in Portugal desires to be placed in communication with firms in the United States engaged in undertakings such as electrification of railways and transmission of electric power; and to secure literature and catalogues from manufacturers of material and accessories pertaining thereto. No. 35284.

An advertising agency firm in South Africa desires to secure the representation of firms for the advertising of American goods in South Africa. Reference. No. 35293.

A request has been received from firms in South Africa for machinery for extracting oil from peanuts and cotton seed, as these products are available there in large quantities. Manufacturers of such machinery should forward catalogues, photographs, blue prints, and prices. No. 35295.

A commercial agent in Ireland desires to secure the representation of firms for the sale of any good selling articles of the hardware trade, ironmongery, etc. Quotations should be given c.i.f. Irish port. Reference. No. 35296.

A commission agent in the Netherlands desires to secure an agency for the sale of small tools, and accessories for motor cycles and motor cars. Quotations should be given c.i.f. Rotterdam. Payment to be made upon receipt of goods. Samples and catalogues are requested. References. No. 35300.

An importer in Victoria, Australia, desires to purchase advertising novelties and specialties. Quotations should be given c.i.f. Australian port. Payment to be made against documents. No. 35303.

Blue Prints on Axles for Railway Cars in Spain Received

Commercial Attaché Charles H. Cunningham, of Madrid, has transmitted blue prints for mounted axles desired by a combination of Spanish manufacturers. This material is on file in the Bureau's district office at 734 Customhouse, New York, N. Y.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

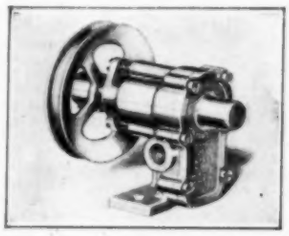
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pump, Coolant, Universal

Alemite Die Casting and Mfg. Co., 2640 Belmont Ave., Chicago, Ill.

"American Machinist," May 19, 1921.



The pumps are made in five sizes with a range of capacity from ½ to 10 gallons per minute, when run at their rated speed of 300 r.p.m. They are adapted to the handling of different sorts of coolants, oils and heavy fluids. The parts are made chiefly of die castings of a hard metal having a high tensile strength. The drive shaft can be extended to receive any desired type of power transmission. There are only four moving parts, the crankhead, rotor, oscillator, and the extension. The rotor is constantly kept in contact with the casing by means of a spring placed between the shaft and crankhead, which construction allows for the passage of any foreign substance through the pump.

Planer, Table, Box-Form

G. A. Gray Co., Cincinnati, Ohio.

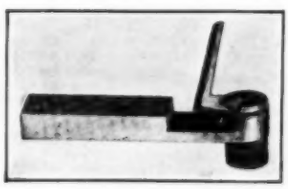
"American Machinist," May 19, 1921.

The illustration shows the box type of construction used for the tables of the planers recently made by the concern. The objects which this design seeks to attain include ease in cleaning, freedom of the V's from chips and dirt, and a great degree of rigidity. In order to further stiffen the table, the top and bottom surfaces are tied together by a heavy, uninterrupted vertical wall of metal running the entire length of the table on its center line. On each side, posts of metal serve the same purpose. Heavy transverse walls at two-foot intervals provide against arching under the strains imposed by the clamps and stop-pins. The stop-pin holes pass entirely through the table top. The cleaning is done from the side. Wide and deep chip pockets are provided at the ends of the table, to safeguard V's and the gearing against chips.

Gage, Combination Square and Bevel

Scalbom Manufacturing Co., 11 S. Desplaines St., Chicago, Ill.

"American Machinist," Apr. 21, 1921.

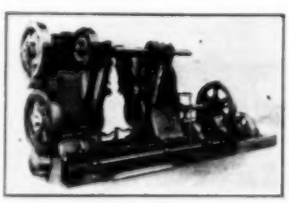


This combination die square and bevel gage is intended for use in laying out tapers and angles on dies and similar work, the body of the tool being held while the blade is swiveled to the desired angle. A locknut is provided for clamping the blade in position. The tool is of steel throughout, hardened and ground, and the blades are furnished in a variety of thicknesses.

Seaming Machine, Double, Horizontal, Duplex

Niagara Machine and Tool Works, Buffalo, N. Y.

"American Machinist," May 26, 1921.

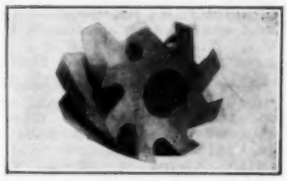


The machine is intended for double-seaming simultaneously both ends of sheet-steel barrels or drums. It is capable of seaming barrels from 18 to 36 in. in diameter, from 20 to 45 in. in height and made of No. 12 gage or lighter steel. It is handled by only one man. The right-hand column slides horizontally on the bed and is moved by a hydraulic cylinder. The pressure of the hydraulic cylinder clamps the barrel between the two chucks and forces the heads into their proper position. The curling rolls curl the seams and the flattening rolls finish them. Only about forty revolutions of the barrel are required to complete the seams. Twenty-five horsepower is required to operate the machine. The machine is 93 in. high, 62 in. from front to back and 211 in. from right to left. Equipped with one set of rolls it weighs approximately 21,000 lb.

Cutter, Milling, Helical, Savy

A. Savy, Jeanjean & Co., Courbevoie, near Paris, France.

"American Machinist," May 19, 1921.



The mill can be furnished in various sizes and numbers of teeth. The helix angle is 30 deg. The wide-spaced teeth are undercut, and have a rake of 10 deg. To sharpen, they are ground on the front faces only. Besides the high metal-removing capacity of the cutters, the following advantages are claimed for the tool: First, the 30-deg. helix angle eliminates the chatter, particularly with a deep cut; second, no chip breakers are required; third, the tooth is very much stronger than in a standard cutter; and fourth, the sharpening of the cutter does not decrease the chip space, but on the contrary it increases it.

Platform, Lift-Truck, Steel-Bound

Steubing Truck Co., 141 Fourth St., East Cincinnati, Ohio.

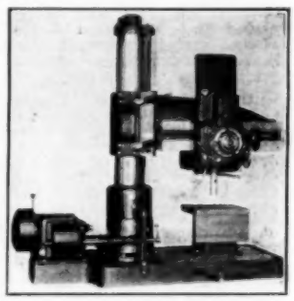
"American Machinist," Apr. 14, 1921.

This portable platform is made of oak bound with angle steel, and supported by steel legs which are made with broad bearing surfaces, so as to decrease the possibility of injuring floors. The bolts and nuts with which the platform is assembled bear on steel plates so as to save wear on the wood. The platform is made in sizes and can be furnished in box type, sectional bin type, stake type, table type, or other designs. The platform is said to possess strength and convenience of operation and to be adaptable to all type of lift-truck work.

Drilling Machine, Radial, Ball-Bearing, Heavy-Duty

Carlton Machine Tool Co., Cincinnati, Ohio.

"American Machinist," May 26, 1921.



The machine is intended for general work, and is built in three sizes, having 4, 5 and 6 ft. arms, respectively. All running parts are mounted on ball bearings for both radial and thrust. An extension on the rear of the base serves for mounting either a variable-speed motor or a speed-change gear box and constant-speed motor. However, either type of motor can be mounted on an extension of the arm on the opposite side of the column from the head. The hollow cylindrical column is hung from the top on a ball thrust bearing, and a roller bearing is used at the bottom, so that the arm can be very easily swung. All gears are completely inclosed. The spindle head is said to be balanced on the ways of the arm.

Drilling Machine, Suspended

Reed-Prentice Co., 53 Franklin St., Boston, Mass.

"American Machinist," May 26, 1921.

The machine is suspended from the ceiling and fastened thereto by screws or bolts. There is nothing on the machine to interfere with work that may be brought under it. Owing to the construction of the frame, no trussrods are needed. The spindle is counterbalanced, has hand and power feed, a quick-return movement, and three changes of feed. The operating mechanism resembles that found on the usual type of upright drilling machine. The work can be held in any manner desired, because of the absence of the machine table. The machine is capable of drilling holes up to 2 in. in diameter. A countershaft is furnished.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

Adrien Lambercier of J. Lambercier & Co., Geneva, Switzerland, agents in Switzerland for American machine-tool builders, has recently arrived in New York. While in America he will make his headquarters at the *American Machinist* offices.

Frank Miller has been re-elected president of the Burch Plow Works, Crestline, Ohio, J. L. Morrow, secretary and general manager and Miss Edna Volk, treasurer.

W. N. Roach, formerly engaged in patent work for the War Department, has left that service to start a private patent practice in Washington. Mr. Roach has been with the War Department since August, 1918.

Ralph C. Schwartz has taken over the Northwestern New York territory for the distribution and sale of Stewart industrial furnaces and appliances. Mr. Schwarz will be located at 921 Granite Building, Rochester, New York.

Hugo Diemer has been appointed director of the new Industrial Management Division of La Salle Extension University. This division will comprise industrial management efficiency, modern foremanship and production methods, and personnel management.

Adolph F. Soben, until recently assistant chief engineer for The American Machine & Mfg. Co., Atlanta, Ga., has opened offices in Los Angeles as consulting engineer and designer of special and automatic machinery.

C. Whitey Crosby has resigned as production engineer for the Automatic Signal Co., St. Paul, Minn., and has become associated with the Chas. L. Pillsbury Co., consulting engineers, of Minneapolis, Minn.

George McQuilkin, proprietor of the Enterprise Machine Works, Elkton, Md., will discontinue business owing to poor health.

E. C. Welborn, formerly with the Illinois Steel Co., first in structural shop work and engineering and from 1914 to 1919 as assistant manager of credits and collections and in charge of business and financial investigations and reports, has opened offices at 29 South LaSalle Street, Chicago, as a business and engineering counsel.

William H. Savage, Fitchburg, Mass., dealer in machine tools, has purchased the assets of the Powell Machine Co., Worcester, Mass., builders of planers, appraised at $247,000, and will sell them at private liquidation sale in lots to suit the purchasers.

Frank S. Spencer, 1265 Boylston Street, Boston, has been appointed representative in the New England district for the sale of variable section rolled products made by the Witherow Steel Co., Pittsburgh.

Alexander H. Holliday, manager of exports of the Jones & Laughlin Steel Co., Pittsburgh, with W. W. Ewing, a special representative of that company, have just returned from a business and sight-seeing tour in Mexico. They attended the first international trade congress held in Mexico City, June 20-26, at which Mr. Holliday was a special delegate of the United States Chamber of Commerce. While issuing no formal statement at this time, he looks upon Mexico as a fruitful field for the American steel industry.

Major Dwight K. Shurtleff, U. S. Army, has been decorated by King Albert of Belgium in appreciation of his services in obtaining machine tools for rebuilding Belgian factories.

Stewart C. Wilson has been appointed Pittsburgh district sales manager of the Whiting Corp., Chicago, succeeding Robert S. Hammond, transferred to the Chicago office.

Robert Wilson has resigned as superintendent of the Fabricated Steel Products Co., Leetonia, Ohio, and now is connected with the Adams Mfg. Co., East Palestine, Ohio.

Aldus C. Higgins, treasurer and general counsel of the Norton Co., Worcester, Mass., sailed from New York, July 30, for a three months' tour of Europe.

Samuel M. Vauclain, president of the Baldwin Locomotive Works, Philadelphia, left last week for Mexico City, where he will confer with President Obregon and other officials of the Mexican government on the railroad situation there.

Lawrence Johnson, factory engineer of the Collins Co., Collinsville, Conn., edge tools for 19 years, and now associated with Perin & Marshall, New York, consulting engineers, will leave for India next month where he will assume the position of works manager at the Jamshedpur plant of the Agricultural Implements Co., Ltd., Bombay.

George E. Harris, general manager of sales of the Falcon Steel Co., Niles, Ohio, has resigned to engage in the steel business in Detroit. Mr. Harris has been connected with the steel business, in both operating and commercial ways, for about 30 years. His successor has not yet been announced.

R. D. Love, former sales manager and buyer for the Betz-Pierce Co., Cleveland, Ohio, and more recently with the sales department of the United Alloy Steel Corp., Canton, Ohio, has been made manager of sales for the Warren Iron and Steel Co., Warren, Ohio.

J. Arthur Deakin, with office at 150 Nassau St., New York City, has been appointed sales representative for Greater New York for the Louisville Electric Manufacturing Co., Louisville, Ky., manufacturer of the Pioneer portable electric tools, including drilling machines, hand grinding machines, electric screw drivers and valve grinders.

Carl S. Neumann, assistant secretary of the Union Mfg. Co., New Britain, Conn., who has been on a European trip for about three months combining business with pleasure, will sail for home from Southampton, Eng., Aug. 3.

New Publications

The Federal Administration and the Alien. (A supplement to "Immigration and The Future"), by Frances Keller. Eighty 5¼ x 8-in. pages. Published by the George H. Doran Co., New York.

With the European countries in a more or less chaotic state in-so-far as industrial and living conditions are concerned, and with the United States richer than it ever has been, the rush of immigrants to our shores has developed a problem of such magnitude that Congress has already taken steps to limit and otherwise regulate the mad scramble. In "The Federal Administration and the Alien," Miss Keller presents the different angles of this problem, explaining the state of the present facilities for handling the immigrants and uncovering the weak spots in our present immigration policy.

The immigrant's side of the story is also presented, with what the immigrant's impressions must necessarily be as a result of being buffeted about through the confliction of state and federal efforts at regulation, and the obvious results of such impressions. The events of the past few years have impressed upon even the most casual observer the necessity of scientific regulation of immigration, and this volume will be interesting to those who are following the Government's efforts along this line.

Discussion of the National Electrical Safety Code. Handbook No. 4. Published by the Bureau of Standards, Dept. of Commerce, Washington, D. C. Three hundred and thirty 5 x 7¼ in. pages, 38 line drawings, 2 tables.

This book contains a discussion of the rules of the National Electrical Safety Code as published in Handbook No. 3, including many items and suggestions which are not involved in the rules themselves, but which have bearing upon good practice and matters intimately related to the subject of rules. The rules discussed are those covering methods of protective grounding of circuits, equipment and lightening arresters for stations, lines and utilization equipment; rules for the installation and maintenance of electrical supply stations and equipment; rules for the installation and maintenance of overhead and underground electrical supply and signal lines; rules for the installation and maintenance of electrical utilization equipment, rules to be observed in the operation of electrical equipments and lines; rules for the employer, rules for the employee; and rules for commercial telephone and telegraph systems.

This publication is now ready for distribution and copies may be obtained by addressing the Bureau.

Technologic Paper No. 192 (Tests of Centrifugally Cast Steel). Bureau of Standards, Department of Commerce, Washington, D. C.

The production of metal castings by the centrifugal process may be said to have passed the experimental stage; at least in the case of certain non-ferrous metals and cast-iron shapes. However, very little appears to have been published concerning centrifugally cast steel. This paper shows the results of a detailed examination, made by the bureau, of six centrifugally-cast castings which were made by the Millspaugh process. This record of the results, which includes a comparison of the metal with that of the ordinary casting, is interesting. It is stated that the castings were sound and free from chemical segregation, and that with subsequent heat-treatment the metal in the castings would compare favorably with metal that has been forged.

A copy of this paper may be had from the Superintendent of Documents, Washington, D. C., at ten cents per copy.

Cam Design and Manufacture. By F. B. Jacobs. Cloth board covers, 118, 6 x 9-in. pages, 89 illustrations. Published by D. Van Nostrand & Co., 8 Warren St., New York.

In this book the author lays particular stress on the fact that cams, unless properly designed, will be noisy in action, especially when run at high speed. The reasons for this are thoroughly explained by the use of diagrams.

Methods of producing cams both by cutting and grinding are described and some of the machines used are illustrated. Naturally cams for automotive engines and the methods of their production are given much consideration. One of the features of the book is the total absence of mathematical formulas, diagrams being used in their place. This, to the average practical man, makes the problems treated much more easily understood.

The author is to be congratulated on having dealt with a complex subject in such a simple, yet thoroughly understandable manner.

Iron and Steel in Sweden. Edited and published under control of and in cooperation with Jernkontoret by Aktiebolaget, Svenska, Teknologforeningens Forlag, Stockholm, Sweden. One hundred eight-three 7¼ by 9½ in. pages, 79 reproductions from photographs, 9 maps and 3 tables.

This book is published for the purpose of supplying purchasers abroad with clear, easily accessible and correct information concerning the various products manufactured and exported by Swedish iron and steel works. A list of producers and products is included, which gives the names of the manufacturers who export the goods in question, with necessary information concerning postal and telegraphic addresses, codes, and export ports. The greater part of the book is given over to descriptions of Swedish iron and steel works, with illustrations of the plants and their various departments. Those who have use for a directory of this kind will find this volume both interesting and complete in the essential details. Copies may be had by addressing A. B. Svenska, Teknologforeningens Forlag, Postfack 644, Stockholm, Sweden.

Financing an Enterprise. By Hugh R. Conyngton, published by Ronald Press Co. Three volumes, cloth binding, 667 pages.

The author of this very practical work is the "Francis Cooper" who wrote the previous editions on this subject. The publishers state that the work will be interesting to those who desire to finance new enterprises as well as to bankers, lawyers and investors, and, by one who has read the books, it may be added that the work is full of value to anyone engaged in any commercial enterprise.

It is a perfectly natural thing that an author should, in the majority of cases, content himself with a discussion of how things should be done, but the writer of this review has found even more interesting those chapters which discuss the many ways in which things should not be done. There are numerous pitfalls, in the course of human affairs, which look very safe to the average man. The eternal succession of failures that have been caused by the same old troubles is the tragedy of modern business. That one should fail from time to time when testing new methods is no cause for surprise, and if the cause of their failure can be made known, they have contributed something, if nothing more than to hang out a sign "Detour," to those who would travel the same road.

Mr. Conyngton has given us all an opportunity to profit by the experience of a host of failures, brought about in almost every instance by what "anybody should know."

The book is easy to read and understand and in no sense does the author content himself with danger signs or "how not to do things." A major part of the work is just the reverse in that it shows the short cuts and the right way to accomplish one's legitimate desire. The outstanding features are how to determine if an enterprise is sound; the investigation, protection, organization, and incorporation; and the presentation, promoting and financing of the project.

THE WEEKLY PRICE GUIDE

This Week's Market

Warehouse prices in New York show little change since last week, but slightly larger orders indicate improvement. Mill shipments, New York, show no increased activity; structural shapes and plates quoted at $2.18 to $2.23, bars at $2.13. Pig iron prices down $2 to $6 per ton. The same prices on structural shapes prevail in Chicago as in New York. Electrolytic copper has dropped ¼c., copper sheets ½c., and copper bars 1c. per lb. in New York. Reductions of ½c. per lb. on tin and ¼c. per lb. on solder, are reported. Copper sheets have been reduced ¼c., antimony ½c. and babbitt metal 2c. per lb. in Cleveland.

Market for shop supplies growing firmer, reflecting no changes in warehouse prices. New York quotes long term plate at $7.25 as against $7.50; linseed oil reduced from 80c. to 78c. per gal. (5 bbl. lots).

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$23.50
Northern Basic	21.52
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*19.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	21.26
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.46
Basic	19.96
Bessemer	21.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$2.88
Soft steel bars	2.78	2.64	2.70
Soft steel bar shapes	2.78	2.64	2.70
Soft steel bands	3.43	...	...
Tank plates	2.88	2.74	2.88

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	2.78

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.53
No. 12	3.15	3.58	3.30	3.58
No. 14	3.20	3.63	3.35	3.63
No. 16	3.30	3.73	3.45	3.73
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.45
Nos. 22 and 24	3.85	4.10	3.85	4.50
No. 25 and 26	3.90	4.15	3.90	4.55
No. 28	4.00	4.25	4.00	4.65
Galvanized				
No. 10 and 11	4.00	4.25	4.00	4.95
No. 12 to 14	4.10	4.35	4.10	5.05
Nos. 17 and 21	4.40	4.65	4.40	5.35
Nos. 22 and 24	4.55	4.80	4.55	5.50
No. 26	4.70	4.95	4.70	5.55
No. 28	5.00	5.25	5.00	5.65

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.23	$4.23	$4.00
Flats, squares and hexagons, per 100 lb.	4.73	4.23	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 7.15; 5/16 to ½, 6.75. Swedish iron in Chicago sells for 17½c per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel	8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	3.09	5.23

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	64½	52	⅜ to 1¼	39½	24½

LAP WELD

2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	12½@13
Tin in 5-ton lots	26.62½
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	20.75	22.50
Copper wire (carload lots)	15.50	16.50	18.50
Brass sheets	15.75	18.00	10.75
Brass pipe	18.50	22.00	22.50
Solder (half and half) (case lots)	17.75	20.25	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	17.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and shot	41
Electrolytic	44

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold drawn rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$9.50
Copper, heavy, and wire	9.00	9.00	8.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	18.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	36.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, $\frac{7}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60–10%	60%
1¼ and 1½ in. by 3 in. up to 12 in	40%	50–5%	55%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $3.00 Cleveland..... $4.50 Chicago..... $4.50
For cast-iron washers, ¼ and larger, the base price per 100 lb. is as follows:
New York..... $4.25 Cleveland..... $3.75 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¼ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	net	net
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50–10%	60–10%	60%
Tinned	50–10%	60–10%	45%

Structural, ¼, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$3.68 Pittsburgh..$2.65
Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$3.78 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	18.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.25.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	14.25
Colored mixed	5.50@ 9.00	6.50@10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.65

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	2.75

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.78	$0.83	$0.84
5-gal. cans	.81*	.98	1.04

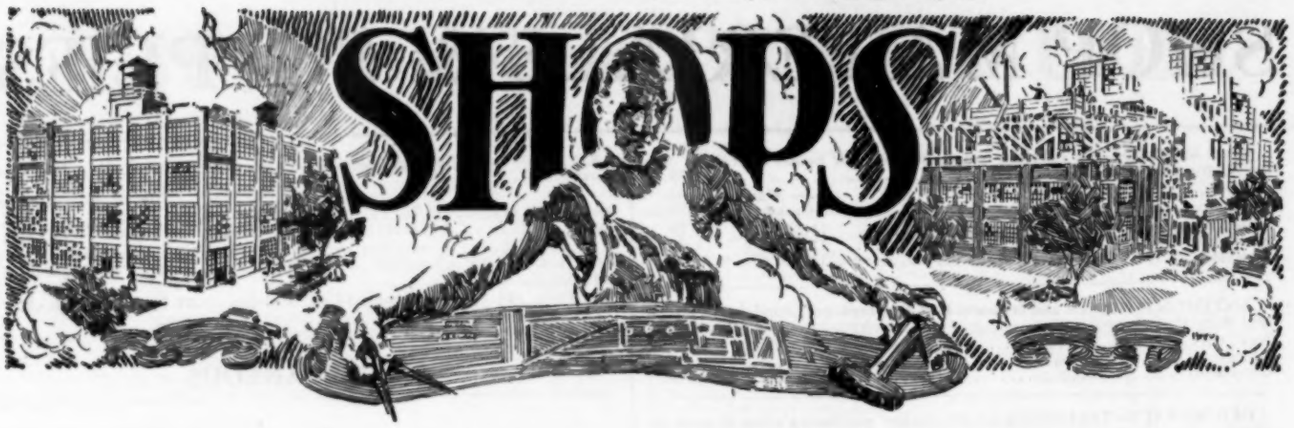
*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED SHOPS



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Northampton—W. E. Quinn Co., manufacturers of saws—back geared power press

N. J., Camden—The Bd. Educ., City Hall—equipment for proposed printing shop including one 10 x 15 C. & P. job press.

N. Y., Niagara Falls—The Carborundum Co., Buffalo Ave. and 18th St.—one 20 in. back geared Buffalo drill press.

Pa., Philadelphia—A. Box & Co., Inc., 813 North Front St.—No. 7 Bardons & Oliver universal turret lathe, No. 2A Warner & Swasey universal turret lathe, No. 6 Warner & Swasey universal turret lathe.

Pa., Philadelphia—Phoenix Metal Stamping Co., 2823 West Fletcher St.—three power punch presses.

La., New Orleans — The Commercial Garage Co., 915-21 Conti St., F. M. Mills, Pres.—complete equipment for auto repair work.

Va., Bristol—Enterprise Fdry. & Machine Wks., Shelby St., C. P. Daniel, Vice Pres. and Gen. Mgr.—punch and shear, bulldozer, plate bender, wood planer, band saw, forges and forge blowers.

Va., Richmond—H. W. Staples, 600 West Marshall St.—drill press and lathe.

Va., Richmond—Wingfield & Hundley, 13 North Governor St., A. Wingfield, Purch. Agt.—medium size shaper for electric repair shop.

Ill., Chicago—Amer. Forge & Mfg. Co., 2433 West 48th St.—24 in. G. & E. shaper and hot or cold circle saw to cut 3 in. hot.

Ill., Chicago—Wilson Steel Products Co., 49th St. and Western Ave.—automatic riveting machine for riveting beaded cold rolled hoops.

Mich., Detroit — Bushnell - MacQueen - Bushnell Agency, 817 Kresge Bldg.—punch press weighing not less than 2,100 lbs., stroke not less than 3 in. (used preferred).

O., Columbus — Madden, Atkinson Auto Co., 160 South 17th St., R. P. Atkinson, Vice-Pres. and Serv. Mgr.—equipment for service station including lathe, drill press, grinders, shapers, etc.

O., Defiance—The Defiance Screw Machine Products Co.—Garvin duplex horizontal drill.

O., Mt. Gilead—Hydraulic Press Mfg. Co.—cut-off saw.

O., Toledo—The Natl. Supply Co., St. Clair and Washington Sts., manufacturer of boiler and radiation supplies—one 26 in. Barnes self oiling all geared drill with tapping attachment.

Wis., Edgerton—Highway Trailer Co., J. Menhall, Purch. Agt.—lathes and drill presses.

Wis., Milwaukee — Exceletone Phonograph Co., 860 Teutonia Ave., C. Kronis, Purch. Agt.—one 12 or 16 in. joiner, one 26 in. band saw and a 16 in. cross cut saw.

Wis., Milwaukee—Milwaukee Auto Service Co., 1520 Grand Ave.—speed lathe or small bench lathe for auto repair work.

Ark., Little Rock—Huckabee Tractor & Mfg Co., 704 South Valmar St., N. F. Wilson, Mgr.—One 14 ft. x 24 in. heavy duty engine lathe.
One 16 ft. x 32 in. heavy duty engine lathe.
One 8 ft. x 16 in. heavy duty engine lathe with taper attachment.
One No. 2 Universal cutter and grinder.
One 36 in. automatic spur gear cutter.
One 20 in. high speed crank shaper.
One 24 in. sliding head upright drill.
One No. 2 heavy Universal milling machine.

Ia., Ft. Dodge—Bd. Educ., c/o C. A. Helsell, Secy.—manual training equipment for proposed high school.

Mo., St. Louis—Fulton Iron Wks., 1259 Delaware Ave.—one 54 in. x 26½ ft. bed geared engine lathe and a 60 in. x 26 ft. geared head engine lathe.

Neb., Lincoln—The Bd. Educ., c/o J. G. Ludlam, Secy—manual training equipment for proposed high school.

Ont., Owen Sound—Deans Garage—garage and auto shop equipment.

Md., Baltimore—Co-operative Paper Box Co., 3502 Cottage Ave., B. F. Garrett, Press.—machinery for the manufacture of paper boxes.

Fla., Dade City—The Florida Cane Syrup Co., E. S. Slough, Mgr.—machinery for making syrup.

Fla., Sarasota—Sarasota Fruit Products Co., C. F. Conkling, 267 Main St., Hackensack, N. J., Purch. Agt.—machinery and equipment to manufacture fruit products, etc.

Tenn., Memphis—Stryker Kot-N-Wood Products Co., Inc., 510-12 McCall Bldg., manufacturers of building materials from cotton stalks, J. T. Stryker, Purch. Agt.—hydraulic presses, brick and tile machinery, shredding machinery to shred cotton stalks into fibers, incinerators, ovens, retorts.

Va., Portsmouth—Planters Mfg Co., Inc., manufacturers of fruit and vegetable crates, etc., W. W. Hargraves, 110 Mt. Vernon Ave., Gen. Mgr.—crate and basket stapling machines, cut-off, rip-saws, planer and veneer drier, 60 to 100 ft. long.

W. Va., Huntington—Huntington Coal & Mining Co., 601½ 9th St., J. M. Hall, Secy. and Treas.—machinery and equipment for 3 large coal operations.

O., Cleveland—Hart Mfg. Co., 2319 East 20th St., manufacturers of adjustable threading tools—machine for drilling ⅝ in. hole and larger.

O., Columbus—The Columbus Show Case Co., 423 North Grant Ave., W. F. Aschinger, Gen. Mgr.—saws and other wood-working machinery.

Wis., Appleton—Traas Candy Co.—machinery for making candy.

Wis., Madison—Capital City Pattern Co., 613 Williams St., W. J. Gregersen, Purch. Agt.—wood working machinery.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave.—cement block machinery.

Wis., Random Lake—Random Lake Co-op. Assn., L. L. Pierron, Pres.—cold storage refrigerating machinery.

Wis., Sheboygan—W. H. Gunther, 902 North 8th St.—ice machine

Wis., Sheboygan—The Wald Mfg. Co., 18th St. and Martin Ave., manufacturers of bicycle and motorcycle accessories—Garvin die slotting machine.
Rolling machine for rolling cold round wire.
Double head bolt cutter equipped with lead screws 1 in. capacity.

Cal., Long Beach—Golden State Woolen Mills, Nadeau Bldg.—$150,000 worth of modern machinery for proposed mill.

Ont., Galt.—Galt Amateur Athletic Assn.—machinery for formation of an artificial ice surface, to be installed in the proposed rink on Shade St.

Ont., Windsor—Essex Provision Co., Ltd., 1120 McDougall St. — refrigeration machinery for proposed cold storage plant.

Metal Working Shops

NEW ENGLAND STATES

Mass., North Adams—Ward Bros., North Troy, N. Y., plan to build a 1 or 2 story garage, etc., on Lincoln and Center Sts., here. Private plans.

Conn., New Haven—Westcott Mapes, Inc., Archts. and Engrs., 207 Orange St., are receiving bids for the construction of a 62 x 142 ft. factory on James St., for the Natl. Folding Box & Paper Co. Estimated cost, $150,000.

MIDDLE ATLANTIC STATES

N. J., Camden—The Wilson Motor Co., 1721 Haddon Ave., has awarded the contract for the construction of a plant on Haddon Ave. Estimated cost, $40,000.

Pa., Beaver Falls—Ingraham & Richardson Mfg. Co., manufacturers of enamel ware, has awarded the contract for the construction of a 1 story, 95 x 129 ft. factory. Estimated cost, $60,000.

MIDDLE WEST STATES

Ill., Chicago—S. Buchsbaum & Co., 159 North State St. (jewelers), plans to build a 6 story, 100 x 175 ft. office and factory building on East Huron and Fairbanks Sts. Estimated cost, $300,000. Architect not selected.

Mich., Detroit—The Street Ry. Comn., 320 Murphy Bldg., will soon award the contract for the construction of a 1 and 2 story car house on St. Jean Ave. Estimated cost, $1,000,000. W. C. Markham, 155 West Congress St., Engr. Noted June 2.

WEST OF THE MISSISSIPPI

Mo., Kansas City—The Grand Ave. Bldg. Co., c/o E. H. Gill, Engr., Interstate Bldg., has awarded the contract for the construction of a 2 story, 80 x 122 ft. garage at 714 Grand Ave. Estimated cost, $100,000.

WESTERN STATES

Cal., Los Angeles—Buttress & McLean, 205 North Los Angeles St., have awarded the contract for the construction of three 1 and 2-story 60 x 280 ft. buildings on 51st and Santa Fe Sts., for the manufacture of mining machinery. Estimated cost, $38,000 each.

CANADA

Ont., Owen Sound—The Deans Garage plans to build a garage on Main St. to replace the one which was recently destroyed by fire. Estimated cost, $75,000.